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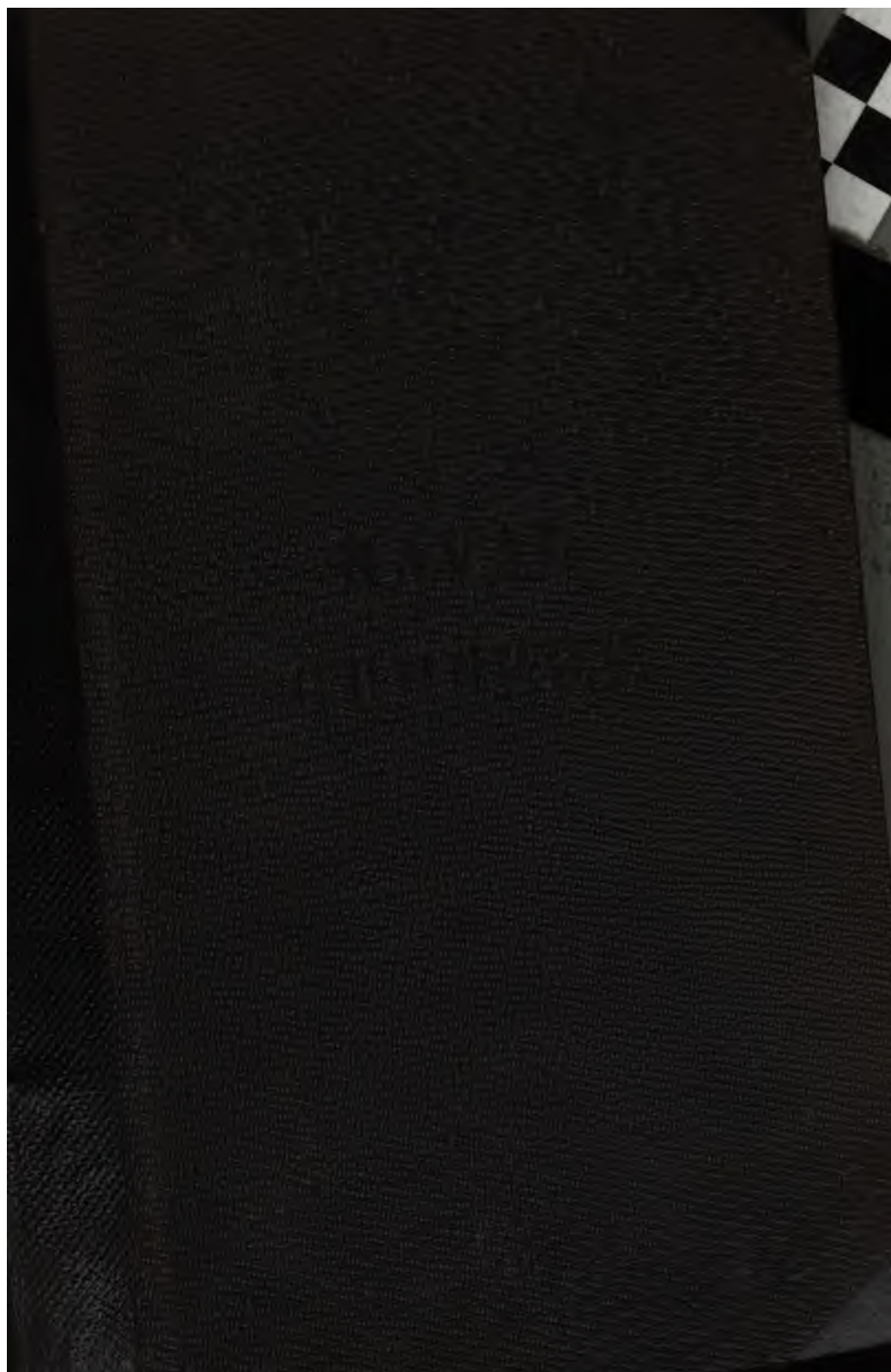
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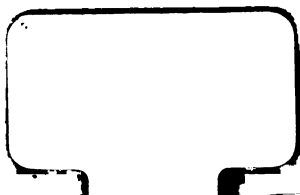
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INSTRUCTIONS
FOR THE
EXERCISE AND SERVICE
OF
GREAT GUNS,
Etc.,
ON BOARD HER MAJESTY'S SHIPS.



LONDON:
PRINTED BY HARRISON & SONS, ST. MARTIN'S LANE.

1858

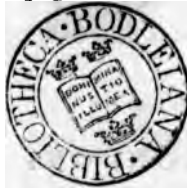
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MEMO.

“Seamen and Marines are not expected to commit to memory, any other details of the Great Gun Exercise than those contained in the following Table, which is a Copy of the Cards issued for that purpose, but they are to be instructed in the Manual Exercise, and to know it practically.

“When men are quartered at a Revolving Gun, they should only learn the ‘Providing Stores’ and ‘Exercise’ for that gun.

“The above does not apply to Officers and Seamen Gunners, who, being Instructors, should be perfect in all the Drills and Details, as explained in pages 124 and 126.”



The accustomed beat of the drum is for Action, when the guns are to be cast loose, loaded, and run out without orders.

"	"	with <i>one roll</i> is for Manual Exercise the same as for action, but without powder.
"	"	with <i>two rolls</i> is to muster for Inspection.

Gun No's. 1, 2, 3, 4, 5, 6. Auxiliaries, 7, 8, 9, 10, 11, 12, 13, 14, &c.

Handspikemen, 9, 10. Rearmen, 14 the right rear-man, 13 the left rear-man (or the two highest Nos.).

1. The Captain. 2. The Second Captain.
3. The Loader. 4. The Sponger. 5. The Assistant-Sponger. 6. The Assistant-Loader.

MAN BOTH SIDES.

LEFT GUNS--3 remains 3; 5 becomes 4; 7, 6; 9, 5; 11, 2; 13, 7; 1 remains 1.

RIGHT GUNS—4 remains 4; 6 becomes 3; 8, 6; 10, 5; 12, 2; 14, 7; and 2, 1.

PROVIDING STORES.

(Both sides manned.)

No. 1.—Provides 3 vent-plugs, priming wire, tube box, spare trigger-line, vent bit, sees the lock fixed and fit for use, and places handspikes.

3.—Shot, and grummet, spare breeching, wet swab, wads, and fuze wrench.
 " " "
 " " "
 4.—Sponge, rammer, worm, and fire bucket.

Stationary and extra Powderman, two cartridge cases and two cartridges each.

NO. 3.—With 68-pr. and 10-inch guns, 3 should provide a bearer, and 4 should assist him in providing shot. Spare locks and hammers are to be provided by the 2nd Captain. Lanterns should be hung up amidships between the ports, and kept in order by the proper No. 4, arrangements being made for lighting them at night quarters.

Shells are always to be provided by the two highest Nos.

Stations for Casting Loose a Lower Deck Gun with 7 men. (Both sides manned.)

NOTE.—No 1 places handspikes, 3 & 4 bear out, and the other Nos. brace up the port; when the port is up, 1 provides stores, 2 & 7 cast off muzzle-lashing, then provide stores and clear away breast-trapping; 5 & 6 clear away and shift slide-tackles; when the slide-tackles are clear, and train-tackle to the rear and luff choked, gives the word "Elevate," sees the bed properly secured, and places coil at P. B., the gun is then run in, searched, loaded, and run out. While the gun is being elevated, 2 & 7 finish whatever is left undone, and whilst loading, 2 coils up the lashings, and 5 & 6 span the breeching.

MAN THE STARBOARD OR PORT GUNS.

GREAT GUN EXERCISE.

The men are only to learn the Exercise for the gun at which they are quartered.

EXERCISE WITH 14 MEN TO A LOWER, MIDDLE, OR MAIN DECK GUN.		EXERCISE WITH 9 MEN TO AN UPPER DECK GUN.	
Nos.		Nos.	
1	The Captain : commands, attends the breeching, primes, points, fires, and stops the vent.	1	The Captain ; commands, attends the breeching, primes, points, fires, and stops the vent.
2	The 2nd Captain ; assists 1, runs out, attends handspike, coin and lock.	2	The 2nd Captain ; assists 1, attends the apron, elevating screw, lock, and train tackle.
3	Loads, rams home, runs out, and trains.	3	Loads, rams home, runs out, and trains.
4	Worms, sponges, rams home, runs out, and trains.	4	Worms, sponges, rams home, runs out, and trains.
5	Gives shot and wad to 3, runs out, trains, and spans the breeching.	5	Gives shot and wad to 3, runs out, trains, and spans the breeching.
6	Gives sponge, rammer, and worm to 4, runs out, trains, and spans the breeching.	6	Gives sponge, rammer, and worm to 4, runs out, trains, and spans the breeching.
7 & 8	Run out and train.	7 & 8	Run out and attend handspikes.
9 & 10	Run out and attend handspikes.	9	Runs out, trains, and brings up shell.
11	Runs out and attends handspike.		
12	Runs out and trains.		
13	Runs out, trains, and brings up shell.		
14	Attends train-tackle.		
<p>NOTE.—With more or less than 14 men, the Exercise will be the same as above, except that the proper handspikemen will take the duties of 9 and 10, the assistant handspikemen, those of 11 and 2, and the rear-men, those of 13 and 14.</p> <p>The Captain of the gun is responsible that all stores and necessary gear are at the gun, and that throughout the exercise all the Nos. perform their duties correctly.</p> <p>NOTE.—Handspikemen, with 5, 6, or 7 men, 5 & 6; with 8, 9, 10 or 11 men, 7 & 8; and with all Nos. above 11, 11 & 2, except with 68-pr., and 10-inch guns, when Assistant Handspikemen will be 11 & 13.</p> <p>A Stationary Powderman is allotted to every gun on one side, and an extra powderman to every two guns.</p>		<p>NOTE.—With guns mounted on Rear chock carriages having side levers for running out, Nos. 7 and 8 will shift the side-tackles, and the left rear-man will attend roller handspike when necessary. With guns mounted on Hardy's carriages, the Exercise will be the same as above, except that No. 4 will attend compressor when the gun is out, and No. 8 when the gun is in.</p> <p>NOTE.—With all Nos. above 11, 9 & 10. Assistant Handspikemen with 10 and 11 men, 9 & 2, and with Nos. 7 and 8 will shift the side-tackles, and the left rear-man will attend roller handspike when necessary. With guns mounted on Hardy's carriages, the Exercise will be the same as above, except that No. 4 will attend compressor when the gun is out, and No. 8 when the gun is in.</p>	
<p>Stations for Casting Loose a Main Deck Gun with 6 men. (<i>Both sides manned.</i>)</p> <p>NOTE.—No. 1 places handspikes, 3 & 4 bear out, and 1 & 2 tries up the half-port; when the port is up, 1 provides stores, 3 casts off and hooks on train-tackle, 3 & 4 clear away and unhook train-tackle, and provide stores, 5 & 6 clear away and shift side-tackles, unhook breeching and span it when the gun is in; when the side-tackles are clear and train-tackle to the rear, 1 gives the word "Elevate," and withdraws the coin to allow 3 & 4 to put down the lower half-port; he then sees the bed properly secured and places coin at P. H. the gun is then run in, searched, loaded, and run out.</p> <p>With 7 men, 7 will assist 2.</p> <p>With 6 men, 1 will hook on train-tackle.</p>		<p>NOTE.—With all Nos. above 11, 9 & 10. Assistant Handspikemen with 10 and 11 men, 9 & 2, and with Nos. 7 and 8 will shift the side-tackles, and the left rear-man will attend roller handspike when necessary. With guns mounted on Hardy's carriages, the Exercise will be the same as above, except that No. 4 will attend compressor when the gun is out, and No. 8 when the gun is in.</p> <p>NOTE.—With all Nos. above 11, 9 & 10. Assistant Handspikemen with 10 and 11 men, 9 & 2, and with Nos. 7 and 8 will shift the side-tackles, and the left rear-man will attend roller handspike when necessary. With guns mounted on Hardy's carriages, the Exercise will be the same as above, except that No. 4 will attend compressor when the gun is out, and No. 8 when the gun is in.</p>	
<p>"NINE WORDS OF COMMAND."—"Prime," "Point," "Fire," "Stop the Vent," "Ready," "Sponge," "Load," "Run out."</p>		<p>"NINE WORDS OF COMMAND."—"Prime," "Point," "Fire," "Stop the Vent," "Ready," "Sponge," "Load," "Run out."</p>	

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INSTRUCTIONS

FOR THE

EXERCISE AND SERVICE OF GREAT GUNS

ON BOARD HER MAJESTY'S SHIPS.

EVERY ship should be prepared to defend herself when attacked, on both sides. On assembling at quarters for action or exercise, the men are to repair to their respective sides according to their watches, providing and distributing the several articles allotted them.

The First Captains, and half the crew of the guns (the men designated by the odd numbers,) remain by their proper guns; the Second Captains, and the remainder (designated by the even numbers,) man the guns on their right.

Stationary powdermen are allotted to every two guns: they are to have two cases; that containing the reserve cartridge, is to be *hung up* in rear of the gun amidships.

An extra powderman, whose duty it will be to fetch powder from the magazine scuttle, and supply the stationary powder-

man, is to be allotted to every four guns, that the reserve cartridge may not at any time be left without protection.

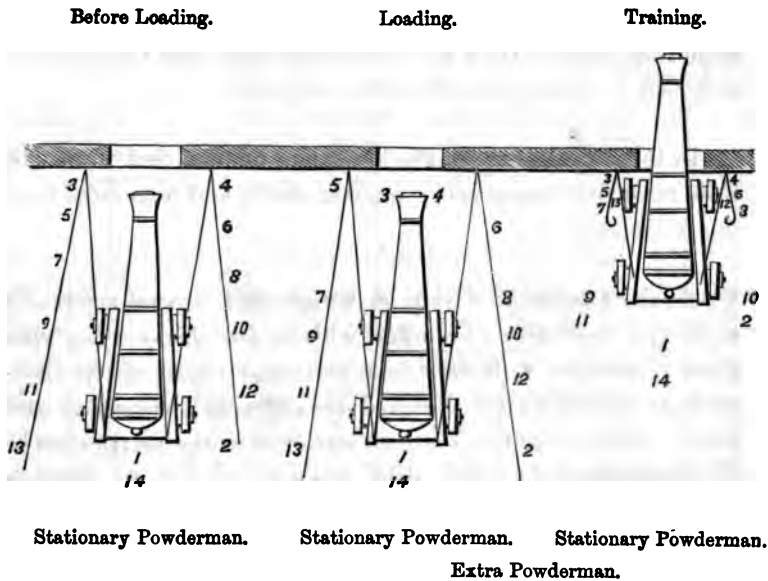
The gun and its opposite should bear the same number, beginning from forward with No. 1 on each deck.

The men appointed to work the gun are to be distinguished by numbers, which will be assigned according to the complement of men stationed at each gun, as hereafter described.

The crews and powdermen of the odd-numbered guns should be composed entirely of the starboard watch, and the even-numbered guns of the port-watch; this will enable whole guns' crews to be worked together in their watch on deck, without disturbing the watch below, and will also enable the Commanding Officer to take the best men from both watches for the Captains of the guns; they should be selected as much as possible from various parts of the ship, so that if a heavy loss of men should occur at particular guns, it would not be more severely felt at one station than at another. Petty officers, or leading men of stations, who are likely to be called upon in action to perform duties as such, are to be quartered at the guns nearest their work.

In assigning the duties, it is premised that the complements of all classes of Her Majesty's ships, small vessels excepted, will admit of the crew of each gun being composed of six persons and the powderman (the latter of whom is not to bear a number), by whom the principal duties in the working and providing for a gun are performed; the first six are to be distinguished as the Gun numbers, and any additional men which its size may require, are to be considered as Auxiliaries, but they are to be equally instructed and rendered competent to perform the several duties of the gun. By this arrangement, one system will be applicable to the working of all the different natures of guns used at sea.

POSITIONS.



The crew, with the exception of the First and Second Captain and powdermen, are to stand with their faces turned obliquely towards the gun and the port, this position being best adapted to secure attention.

The two men whose numbers place them farthest from the ship's side, are to be termed right and left Rear men. The guns on each deck are to be divided into two divisions, called the Foremost and After quarters; and an Officer is to be appointed to command each.

Arrangements are to be made in the different Magazines and passages, for the regular supply of powder to the several decks, under the superintendence of an Officer, to prevent confusion from the intermixture of the cartridges; and the follow-

ing rule should be observed in supplying the different decks with powder, namely:—

In frigates and two-decked ships, the lower and main deck should be supplied from the Fore magazine; and the quarter-deck and forecastle from the After magazine.

In three-decked ships, the lower and middle deck from the Fore magazine; main deck, quarter deck, and forecastle from the After magazine.

As the success of a ship in action will depend materially upon the regularity and order with which this duty is conducted, attention to it must be a particular object of the Lieutenant's care who may command the different divisions on each deck. He is to caution the men stationed at the scuttles not to keep full boxes in reserve within the screens or in the passages leading to the magazine—a practice which might lead to serious consequences.

The fire screens are to be kept fixed, rolled up, and protected from the weather.

NOTE.—The above arrangement refers to Magazines as at present fitted.

SCHEME FOR QUARTER BILLS.

To ensure uniformity in the Quarter Bills of Her Majesty's Ships, the accompanying Scheme is to be adopted as a general outline. The variety in the Armaments, the different construction of Magazines, and the difference of horse-power in Steamers, will make some alterations necessary; but it is to be observed, that the full complement of men assigned to each nature of gun is most essential, and that when changes are necessary, they should be made in the number of Small arm men and Riggers.

STATIONS.	1st Rate.	2nd Rate.	3rd Rate.	4th Rate.	5th Rate.	6th Rate.	Sloops.		Established number of Men for Guns of each Calibre.
	"Duke of Wellington" 131 Guns.	"Renown" 91 Guns.	"Sampson" 70 Guns.	"Barvaline" 51 Guns.	"Tribune" 31 Guns.	"Pearl" 21 Guns.	"Camelion" 17 Guns.	"Swallow" 9 Guns.	
Marine Small Arms	50	30	25	45	30	20	15	10	Men. 17
Seamen Tops and Rigging	74	60	52	34	26	18	10	6	32-prs, 58 and 56 cwt., 13
Magazines and Light Rooms } (new pattern)	20	18	16	12	8	8	6	4	" A, 50 " 12
Shell Rooms	12	12	8	8	8	8	6	4	" B, 45 " 11
Stoke Hole	10	8	6	6	4	4	2	2	" C, 42 " 10
Wings	5	5	5	5	4	3	3	2	" 32 " 9
Con. and Helm	2	2	2	2	2	1	1	1	" 25 " 8
Relieving Tackles	4	3	2	2	1	1	1	1	
Signals	2	2	2	2	1	1	1	1	
Store Rooms	4	3	3	2	1	1	1	1	
Attending the Surgeon	63	59	51	44	37	33	24	19	One Powderman for each gun on one broadside.
Officers	866	670	456	372	222	166	100	54	One extra for every two guns.
Guns									If an odd gun an extra boy is wanted.

When canvas shoots are fitted for the return of empty cases, fewer men will be required for the Magazine. Riggering men should attend lead when required. Men from Helm to Relieving Tackles, should wheel be damaged, assisted by men from the after guns. Civilians, and Sick with the Surgeon. If tubes are required, they should be handed up the fore scuttle by the men in the store rooms.

REMARKS ON THE TRAINING OF MEN AT THE GREAT GUNS.

IN a newly commissioned ship, it is of the utmost importance that the men be trained in the shortest possible time to work the guns; the following plan should therefore be pursued until the Quarters are tolerably efficient.

After the ship is fitted out, go to general Quarters every day, and cast loose all the guns, run them in, and exercise the men in worming, sponging, and loading, for twenty minutes; then run out and exercise on "both sides," pointing at objects, working coils and handspikes, for twenty minutes more; afterwards man *one* side, and exercise the Quarters in slow time with the guns in various positions for another twenty minutes. The Magazine exercise should be carried on at the same time.

In addition to the above, the untrained men should be drilled by themselves in their watch on deck.

In the event of there not being qualified "Captains of Guns" on board, the earliest opportunity should be taken whilst fitting out, to select the fittest men for this duty, and they should be trained by themselves daily, under the instruction of the Gunnery Officer.

FIRST INSTRUCTION.

ASSEMBLING AT QUARTERS.

THE accustomed beat of the drum is for Action; the stationary powdermen repair to the magazine-scuttle for two cartridge-cases and two cartridges, and then return to their places in the rear of their guns amidships, ready to receive all further supply of powder from the extra powderman.

The Gun Nos. provide the stores, and with the Auxiliaries cast loose their respective guns, which are to be searched, loaded with full charges, and single shot, and run out without further orders: but they are on no account to be fired without *distinct* orders from the upper deck.

NOTE.—The above arrangement although it ensures the guns being got quickly ready for action, does not preclude the Commanding Officer from giving orders on beating to quarters, to load with any other charge or projectile he may think best.

The accustomed beat of the drum with one roll is for Manual Exercise, the same as for Action, but no powder is provided.

The accustomed beat of the drum with two rolls is to muster for Inspection: the crews and powdermen repair to their respective sides, unless ordered to the contrary. The stationary and extra powdermen take their places in the rear of their guns amidships. “Fall Out.”

NOTE.—The rolls are to be beaten previously: by this means great celerity will be acquired when the guns are really wanted for action. Orders for casting loose, and preparing for action, will then be unnecessary, as the Officers and men will have been apprised of what is required of them.

DETAIL FOR PLACING THE MEN.

Take your place in the rear of the gun facing the port, as No. 1, the Captain.

Take your place to the right of the gun close to the ship's side, as No. 4, the Sponger, standing quarter-face to the gun.

Take your place to the left of the gun close to the ship's side, as No. 3, the Loader, standing quarter-face to the gun.*

Take your place to the right of the gun next to No. 4, as No. 6, the Assistant Sponger.

Take your place to the left of the gun next to No. 3, as No. 5, the Assistant Loader.

Take your place to the right of No. 1, facing the ship's side, clear of the recoil, as No. 2, the Second Captain.

These six numbers are Gun numbers, and provide stores for, and cast loose, this gun and the gun on the right in their respective watches. All numbers above these are Auxiliaries, who cast loose this gun and the gun on the right in their respective watches.

Take your	} left of the gun next to No. 5 as No. 7.		
place to the			
„ right		„	No. 6 as No. 8.
„ left		„	No. 7 as No. 9.
„ right		„	No. 8 as No. 10.
„ left		„	No. 9 as No. 11.
„ right	„	No. 10 as No. 12.	

And so on with higher numbers. "Close up."

"Gun Numbers."

1, 2, 3, 4, 5, 6.

"Auxiliaries."

7, 8, 9, 10, 11, 12, 13, 14, &c.

"Handspikemen."

9, 10.

"Rear-men."

14. The right rear-man. 13. The left rear-man.

(Or the two highest numbers.)

* This order applies to all Nos. but 1 and 2.

Gun Nos. as placed in rotation on arriving at the gun:—

- | | |
|-----------------|---------------------------|
| 1. The Captain. | 6. The Assistant Sponger. |
| 4. The Sponger. | 5. The Assistant Loader. |
| 3. The Loader. | 2. The Second Captain. |

NOTE.—The Gun numbers are never to be called unless ordered; and when so ordered, Auxiliaries, Handspikemen, Rearmen, and 1, The Captain, &c., are to be called.

MANNING BOTH SIDES.

MAN BOTH SIDES. { Each watch will repair to its respective side, the odd numbers standing to the left of the left guns; even numbers to the right of the right guns.

Left guns, 3 remains 3	Right guns, 4 remains 4
5 becomes 4	6 becomes 3
7 „ 6	8 „ 6
9 „ 5	10 „ 5
11 „ 2	12 „ 2
13 „ 7	14 „ 7
1 remains 1	2 „ 1

NOTE.—The left guns are odd starboard and even port. The right guns are even starboard and odd port.

Guns' crews always man, and powder-boys always supply adjacent guns, when clearing for action or when fighting both sides.

With a crew of 11 men and upwards, and both sides manned, 2 is *always* to attend the train-tackle.

PROVIDING STORES

(both sides manned).

No. 1. Provides 3 vent plugs, priming wire, tube box, spare trigger line, vent bit, sees the lock fixed and fit for use, and places handspikes.

3. Shot, and grummet, spare breeching, wet swab, wads, and fuze wrench.

4. Sponge, rammer, worm, and fire-bucket.

Stationary and extra powderman, two cartridge cases and two cartridges each.

NOTE.—With 68-pounders and 10-inch guns, 3 should provide a bearer, and 4 should assist him in providing shot. Spare locks, and hammers are to be provided by the 2nd Captain. Lanterns should be hung up amidships between the ports and kept in order by the proper No. 4, arrangements being made for lighting them at night quarters.

Shells are always to be provided by the two highest numbers.

“MAN THE STARBOARD OR PORT GUNS.”

**EXERCISE WITH 14 MEN TO A LOWER, MIDDLE, OR
MAIN DECK GUN.**

No. 1. The Captain ; commands, attends the breeching, primes, points, fires, and stops the vent.

2. The 2nd Captain ; assists 1, runs out, attends handspike, coin, and lock.

3. Loads, rams home, runs out, and trains.

4. Worms, sponges, rams home, runs out, and trains.

5. Gives shot and wad to 3, runs out, trains, and spans the breeching.

6. Gives sponge, rammer, and worm to 4, runs out, trains, and spans the breeching.

7 and 8. Run out, and train.

9 and 10. Run out, and attend handspikes.

11. Runs out, and attends handspike.

12. Runs out, and trains.

13. Runs out, trains, and brings up shell.

14. Attends train-tackle.

NOTE.—With more or less than 14 men, the Exercise will be the same as above, except that the proper handspikemen will take the duties of 9 and 10, the assistant handspikemen, those of 11 and 2, and the rearmen, those of 13 and 14.

The Captain of the gun is responsible that all stores and necessary gear are at the gun, and that throughout the exercise all the Nos. perform their duties correctly.

EXERCISE WITH 9 MEN TO AN UPPER DECK GUN.

No. 1. The Captain; commands, attends the breeching, primes, points, fires, and stops the vent.

2. The 2nd Captain; assists 1, attends the apron, elevating screw, lock, and train tackle.

3. Loads, rams home, runs out, and trains.

4. Worms, sponges, rams home, runs out, and trains.

5. Gives shot and wad to 3, runs out, trains, and spans the breeching.

6. Gives sponge, rammer, and worm to 4, runs out, trains, and spans the breeching.

7 and 8. Run out, and attend handspikes.

9. Runs out, trains, and brings up shell.

NOTE.—With guns mounted on Rear chock carriages having side levers for running out, Nos. 7 and 8 will shift the side-tackles, and the left rearman will attend roller handspike when necessary.

With guns mounted on Hardy's carriages, the Exercise will be the same as above, except that No. 4 will attend compressor when the gun is *out*, and No. 8 when the gun is *in*.

Handspikemen with 5, 6, or 7 men	..	5 and 6
„ „ 8 or 9 men	..	7 „ 8
„ „ 10 or 11 men	..	7 „ 8
and Assistant handspikemen	.. ..	9 „ 2
Handspikemen with all Nos. above 11		9 „ 10
and Assistant handspikemen	.. ..	11 „ 2
Except with 10-inch and 68-pounder guns, when Assistant handspikemen will be	.. .. .	11 „ 12

With light guns it may be advantageous in some cases to double man the handspikes. The left rearman will always fire with a hammer or match, and the right rearman will attend the train-tackle, except when he is handspikeman (when 2 will attend it) and in Lower Deck Exercise (when *both* rearman will attend it).

*Arrangement for clearing away Lower Deck Tables
and Stools with 7 Men*

(both sides manned.)

Nos. 2 and 7. To take down mess gear, and remain on orlop deck to place tables, stools, and bread barges.

5 and 6. To pass down tables, stools, and bread barges.

Each gun's crew should be told off for clearing away the mess before or abaft their gun, according as the foremost mess is before or abaft the foremost gun.

Arrangements should be made for passing the tables and stools of the different divisions of guns down different hatchways, and for placing a certain number of tables on the chests in the fore and after cockpits for the wounded. When the tables and stools are triced up overhead, Nos. 2 and 7 take down mess gear, as before, and all the other Nos. assist in putting up the tables and stools *before attempting* to cast loose.

Stations for casting loose a Lower Deck Gun with 7 Men

(both sides manned.)

No. 1 places handspikes, 3 and 4 bear out, and the other Nos. trice up the port; when the port is up, 1 provides stores, 2 and 7 cast off and hook on train-tackle, 3 and 4 cast off muzzle-lashing, then provide stores and clear away breast-frapping, 5 and 6 clear away and shift side-tackles; when the side-tackles are clear, and train-tackle to the rear and luff choked, 1 gives the word "Elevate," sees the bed properly secured, and places coin at P. B., the gun is then run in, searched, loaded, and run out. While the gun is being elevated, 2 and 7 finish whatever is left undone, and whilst loading, 2 coils up the lashings, and 5 and 6 span the breeching.

*Stations for casting loose a Main Deck Gun with 6 Men**(both sides manned).*

No. 1 places handspikes, 3 and 4 bear out, and 1 and 2 trice up the half-port; when the port is up, 1 provides stores, 2 casts off and hooks on train-tackle, 3 and 4 clear away and unhook train-tackle and provide stores, 5 and 6 clear away and shift side-tackles, untoggle breeching and span it when the gun is in; when the side-tackles are clear and train-tackle to the rear, 1 gives the word "Elevate," and withdraws the coin to allow 3 and 4 to put down the lower half-port, he then sees the bed properly secured and places coin at P. B., the gun is then run in, searched, loaded, and run out.

With 7 men, No. 7 will assist No. 2.

„ 5 „ No. 1 will hook on train-tackle.

If the upper half-ports are made to take off, 3 and 4 will take them off.

Filling up Casualties.

When casualties occur at the guns, the Captain of the gun will give the word "Close up" and then equalize the crew on each side, excepting where either Captain is removed, when the next Gun No. should take his place. For instance, with 14 men at a gun, if 1, 6 and 9 fall out, 2 should take 1; 3, 2; 8 moves up and becomes 6; 10, 8; 12, 10; and 14, 12; 5 moves up and becomes 3; 7, 5; 9, 7; 11, 9; and 13, 11. If the powderman should fall out, the highest No. should take powderman.

HANDSPIKE DRILL.

WORDS
OF COMMAND.

The Officer commanding numbers off the guns, according to the number of men, 4 men to a gun, viz., 3, 4, 5 and 6.

MAN THE GUNS
FOR HANDSPIKE
DRILL, & PLACE
HANDSPIKES.

The handspikes are to be placed on the deck with the flat side down and heels inboard, the centre of the handspikes in line with the axletrees, rear handspikes outside. The Nos. stand between the gun and the handspikes facing the ship's side, 3 and 4 in a line with the fore axletree, and 5 and 6 in a line with the rear axletree.

POINT.

The handspikemen pick up their handspikes, face *outwards from the gun*, and place the flat part of them on the deck, clear of the carriage ready to train.

MUZZLE RIGHT.
WELL.

6 outside the brackets.

MUZZLE LEFT.
WELL.

5 outside the brackets.

TWO HANDSPIKES
MUZZLE RIGHT.
WELL.

6 outside the brackets and 5 in.

TWO HANDSPIKES
MUZZLE LEFT.
WELL.

5 outside the brackets and 6 in.

FOUR HANDSPIKES
MUZZLE RIGHT.
WELL.

3 runs up, 4 runs back, 6 outside the brackets and 5 in.

USE HANDSPIKES { 4 runs up, 3 runs back, 5 outside the brackets
MUSKLE LEFT. and 6 in.
WELL.

SHIFT THE REAR { 3 and 4 ground their handspikes, 5 and 6
TRUCK. place their handspikes under the rear axletree
cleats, 3 and 4 shift the trucks.

SHIFT THE RIGHT { 3 and 4 ground their handspikes, 5 places his
FORE TRUCK. handspike under the left rear axletree cleat, 3
takes off the truck and passes it to 4; 5 withdraws
his handspike and stands on the arm of the axle-
tree, 6 places his handspike under the arm of the
right fore axletree, 4 shifts the truck, 3 replaces
the rear one.

SHIFT THE LEFT { 3 and 4 ground their handspikes, 6 places his
FORE TRUCK. handspike under the right rear axletree cleat, 4
takes off the truck and passes it to 3; 6 withdraws
his handspike and stands on the arm of the axle-
tree, 5 places his handspike under the arm of the
left fore axletree, 3 shifts the truck, 4 replaces the
rear one.

RUN { The Nos. place their handspikes in rear of the
THE GUNS UP. axletrees.
WELL.

RUN { The Nos. facing to the rear, place their hand-
THE GUNS BACK. spikes in front of the axletrees.
WELL.

FIRE. { Handspikemen ground their handspikes.

NOTE.—In shifting a fore truck the rear truck is passed under the gun to assist in taking it off, the small coin being placed under the fore axletree from in, out, by 3 or 4, and returned after the truck is shifted.

SECOND INSTRUCTION.

ORDERS FOR MANUAL EXERCISE.

ON coming to the gun, Nos. 1 see the locks fixed and fit for use, vents clear, sights adjusted to the distance named, and the guns searched, loaded, and run out without further orders.

NOTE.—In clearing for action, and on other occasions, all unnecessary noise is to be avoided. The Captains of the guns *alone* should speak, giving their orders in a sharp clear tone, but not louder than necessary for their own crew to hear them.

The heel or inclination of the ship, as shown by a pendulum, or instrument supplied for that purpose to each division of guns, should be given by order, whenever the object cannot be seen from the gun decks.

The guns are always to be laid horizontal, and sights kept at point blank, unless contrary orders are given. The depression chock is always to be used as long as the elevation will admit of it, as the guns are then less liable to be thrown out.

Full charges should always be used, unless contrary orders are given.

NINE WORDS OF COMMAND.

“ Prime.”	“ Ready.”	“ Sponge.”
“ Point.”	“ Fire.”	“ Load.”
“ Elevate.”	“ Stop the vent.”	“ Run out.”

PRIME. { No. 1 opens the tube-box with his left hand,
 takes out a tube with his right, and primes.

NOTE.—Should the vent become choked, it is to be cleared by boring with a vent-bit; and care should be taken not to bend it, as being made of steel it will easily snap.

POINT. { No. 1 retires to the full extent of the trigger-line, leaning well over on his right knee, keeping his left foot clear of the recoil. The handspikemen pick up their handspikes, keeping them clear of the brackets, the assistant handspikemen double into them, the right rear-man attends the train-tackle, and the rest of the Nos. man the side-tackle falls.

NOTE.—No. 1 is to give the necessary orders for training the gun, using the terms “Muzzle right,” “Muzzle left,” when he wishes the muzzle of the gun to be thrown in either direction; he is also allowed to make use of the following signs with the *left* hand to assist in making himself understood.

IN POINTING.—He should move the hand to the right or left, according as he wishes the breech thrown to the right or left.

IN ELEVATING.—He should move the hand up or down *repeatedly*, according as he wishes the breech raised or lowered.

In doubling in to the side-tackles, all the Nos. between the handspikemen and ship's side are to remain on the outside of the falls. The Nos. in the rear of the handspikemen are to pass between the handspikemen and the gun, manning the fall on the inside. 3 and 4 are to keep their eyes on the handspikemen opposite to them, so as to give the time to the other Nos. for hauling on the fall.

Whenever the order is given, “Two handspikes muzzle right” or “left,” 1 makes up his trigger-line, lays it across the neck-ring, and passes between the gun and the handspikeman (who comes inside the brackets), resuming his position in the rear of the gun to look along the sight; as soon as the gun is laid, he again holds the trigger-line.

In “shifting” or “taking off trucks,” 3 and 4 are to attend the fore trucks, and rear-men the rear-trucks, 2 and 11 providing spare ones when necessary.

In fighting weather or lee guns, it will sometimes be necessary to take off the rear trucks, to diminish the recoil in the former case, and to prevent them running out *after* the recoil in the latter.

Whilst training, the men on one side are to be attentive to ease off their tackle as the men on the opposite side haul on theirs.

ELEVATE. { The handspikemen place their handspikes on the steps of the carriage under the breeching, and raise the gun off the coin. 2 steps in with his left foot in a line with the gun, keeping his right clear of the recoil, and withdraws the coin to the full extent; handspikemen lower the gun slowly and steadily. At the word “Well,” 2 forces in the coin, and when he feels the weight of the gun, gives the word “Down” to the handspikemen, springing up to the safety position on the right.

NOTE.—The word "Ready" is to be given immediately the elevation is correct, and the pointing continued till the word "Fire." Should it be necessary to alter the elevation after the word "Ready," 2 is to "half-cock" at the order "Elevate." If firing with so much elevation or depression as to require the use of "inclined planes," they are to be placed by the rear-men; or if a "tripping-coin" is used for depression, it is to be placed by 2, the laniard being passed to 4 to be hitched to the breeching-ring.

When side scales are used for laying guns, the right rear-man is to hold the side scale, and 2 is to attend the coin, and look out for the elevation, under the direction of 1.

When laying guns by marked coin or side scale, with the rear trucks off, an allowance of 2° must be made to correct the elevation.

If a standard be used, 1 is to attend it, and 2 the coin.

Right and left rear numbers raise the breeching for the handspikemen.

READY. { No. 2 steps up to the right of the gun, clear of the rear axletree, cocks the lock with his left hand, and retires.

NOTE.—As soon as the word "Ready" is given, the training Nos. are to let go the side-tackle falls and stand steady till the gun is fired, unless the ship is rolling, when they are to be kept in hand till the moment of firing.

In the event of there being no 2, 1 cocks the lock, but if there be no lock, 1 is to retire beyond the extent of the recoil, and the left rearman is to get the hammer, and place himself in a line with and clear of the rear axletree, facing the port.

FIRE. { No. 1 fires with a suitable jerk, springing up to the safety position on the left. Handspikemen ground their handspikes.

NOTE.—Guns with heavy charges or lee guns that run out again after the recoil, may be prevented so doing by taking off the rear trucks, or by Nos. 7 and 8 placing stop coins in the shape of a shoe with handles, under the fore trucks when the gun is in; 5 and 6 withdrawing them when the train-tackle is taut.

If hammer or match be used, No. 1 is to order the left rearman to fire at the moment when, allowing for the motion of the ship, he is certain he will hit the object. The match (when used) is to be put to the matched priming *before the vent*, to avoid its being extinguished by the explosion. The left rearman returns the hammer or match.

The right rearman is to take in the slack of the train-tackle, and choke or hitch it when the gun is in, 2 will assist, if necessary. The length of the trigger-line should be regulated by the distance required for the gun's recoil. The hook of the train-tackle at the gun is always to be moused.

STOP THE VENT. { No. 1 makes up the trigger-line hand over hand, and lays it across the neck-ring, forces in a vent-plug with his left hand, keeping his thumb on it, and fingers extended along the vent-field, half-cocks the lock with his right hand.

NOTE.—The necessity of stopping the vent with a plug should be particularly impressed upon the men, showing them that if the sponge be thrust well home to the bottom of the bore, and well pressed against it whilst two round turns are given, and the vent well stopped so as to prevent a current of air, no fire can remain.

RUN IN. { All the Nos. man the train-tackle, except 1, and 3 and 4, who overhaul the side-tackles. When the gun is in, 1 gives the word "Well."

NOTE.—The Nos. are to face *inwards*, in going to the train-tackle. The right rearman is to run back smartly, ready to choke the luff; when the gun is in, it is to be immediately laid fair for loading and running out.

Sponge. { Nos. 3 and 4 step inside the breeching together, 3 with his right leg, 4 with his left; 6 faces outwards and takes the sponge, with his right hand over and left under, and gives it to 4, who receives it in the same manner, *forces it hard home to the bottom of the bore in two or three motions*, gives it two round turns, withdraws it hand over hand, gives it two smart taps under the muzzle, and lays it quietly across the breeching; while the sponge is withdrawing, 6 takes the rammer.

NOTE.—When the order "Sponge" is given (if the sponge is kept overhead) all the Nos. in rear of 6 should fall back one pace to give him room to reach it; should 3 (or 4) observe that 1 has omitted to serve the vent, he is to call his attention to it. The gun is to be *wormed* every *fourth* round.

Sponges are frequently supplied too large. Great care should be taken that they fit easy, and go well home into the chamber, particularly with conical chambered guns. A neglect of this is frequently the cause of serious accidents.

Before and after every exercise the guns are to be "searched." Should any burning fragments be drawn out by the sponge or worm, they are to be extinguished by 3, with the wet swab.

LOAD. { No. 3 receives the cartridge from the powderman, (facing inboard) and enters it seam sideways, and bottom first, to the full extent of his arm; 5 gives shot and wad to 3, who enters them; 4 receives the rammer from 6, with his right hand under and left over, and assisted by 3, forces all home together, hand over hand, giving them two smart blows; they then quit the rammer, while

LOAD
(continued.) { 1 pricks the cartridge to ascertain if it is home,
and gives notice to 4. 3 faces the ship's side;
4 springs the rammer, and lays it quietly across
the breeching; 6 returns it; 3 and 4 step out
together; 5 and 6 throw the side-tackle falls to
the rear.

NOTE.—When “extreme trained to the left,” 3 receives and enters the cartridge, 5 enters shot and wad, left rearman attends sponge and rammer if kept overhead.

When “extreme trained to the right,” the powderman comes up to the right of the gun; 4 receives and enters the cartridge; 5 places shot and wad on the gun for 6, who enters them; 8 attends sponge and rammer instead of 6.—With 8-inch guns, Nos. 5 and 6 stand inside the breeching when loading.

“In double shotting,” 7 places the second shot with wad on the gun.

If ordered to “Load with shell,” the shell is to be taken out of the box by the left rearman, in the rear of the gun, amidships, and given to 5, with the fuze outwards; 5 gives it to 3, who enters it, takes off the cap of the fuze, and passes it to 1 (as a security that the fuze has been uncapped); 4 immediately covers the fuze over with the rammer-head, and assisted by 3, forces home shell and cartridge; all the Nos. not occupied in loading should hold the side-tackles in hand, ready to run the gun out, if, by accident, the fuze should be ignited.

With 10-inch guns, 5 and left rearman will bring up the shell in the box, and 3 and 4 will enter it by the box handles.

The cap is never to be taken off until the shell has been entered a short way into the bore; with high elevations, or when rolling, care should be taken that the shell does not slip down the bore, before this is done.

The fuzes of percussion shells have no caps; these shells are brought up as before, entered fuze outwards, and rammed home as a shot.

Although guns should never remain loaded without a junk-wad between the cartridge and shot, it is unnecessary, when in action, to put in a wad after the cartridge; but a grummet-wad is always to be put in (with the crossing outwards) after the shot. Guns should never remain loaded longer than necessary, as the cartridge quickly deteriorates from damp.—If the gun is to be double-shotted, no wad is to be placed between them: when loading with round and case, or grape, the round shot is to be put in first. The men are to be frequently exercised in loading with a dumb cartridge, shot, and wad.

RUN OUT. { All the Nos. man the side-tackles, except the
right rear-man, who attends the train-tackle, and
1, who keeps the gun bearing on the object.
When the gun is out, 5 and 6 coil down the
side-tackle falls.

NOTE.—Should there be much motion, or the ship have much heel, the right rearman, when working lee guns, is to reeve the end of the train-tackle fall up through the train-tackle bolt in the deck, that he may be better able to check the gun from going out too violently; the left rearman is to assist him when necessary. When the rear trucks are off, the handspikemen should work with their handspikes under the arm of the axletree, to diminish the friction in running out.

LOCK PRACTICE.

MISS FIRE. { No. 2 half cocks the lock ; 1 comes up to the left of the gun clear of the rear axletree, makes up the trigger-line, lays it across the neck ring, replaces the tube, and retires.

BURNT PRIMING. { No. 2 half cocks the lock ; 1 comes up to the left of the gun clear of the rear axletree, makes up the trigger-line, lays it across the neck-ring, examines the vent with the priming-wire, if foul, asks 2 for the vent-bit ; the vent being clear, primes, and retires.

SHIFT TRIGGER-LINES. { No. 2 half cocks the lock ; 1 comes up to the rear of the gun, takes out the tube, puts in a vent plug, and assisted by 2, shifts the trigger-line, primes, and retires.

NOTE.—If the trigger-line is to be shifted whilst the gun is being loaded, 2 shifts the trigger-line, and 1 serves the vent.

SHIFT LOCKS. { No. 2 half cocks the lock ; 1 comes up to the rear of the gun, makes up the trigger-line, lays it across the neck-ring, takes out the tube, puts in a vent plug, and assisted by 2, shifts the lock, primes, and retires.

CEASE FIRING. { No. 2 half cocks the lock ; 1 comes up to the rear of the gun, makes up the trigger-line, lays it across the neck-ring, takes out the tube and puts in a vent plug.

NOTE.—Whenever this order is given, the guns if in are to be loaded and run out, unless ordered to the contrary.

“RUN IN.”

SEARCH
THE GUNS.

The guns are to be wormed, sponged, and the vents bored down. The captains of the guns then give the word "Sponge again," holding their faces over the vents to ascertain that the air passes freely through them.

"SQUARE IN THE PORTS, RUN OUT."

SECURING GUNS.

OUT-BOARD.

SECURE
THE GUN.

No. 1 gives the word "Elevate," takes out the coin, and places the parts of the train-tackle under the cascable; 2 unhooks and overhauls the train-tackle; 3 and 4 put in the tompion, haul up the half-port, secure the side-tackles and hook the train-tackle to the side-tackle bolts; 5 and 6 seize the breeching and assist in securing the tackles; stationary powderman returns the powder, and the extra one swabs the deck.

NOTE.—In securing, the breeching (if left-handed rope) is to be rendered through to the *right* of the gun; and the reverse if right-handed rope.

IN-BOARD.

SECURE
THE GUN.

No. 1 gives the word "Run in" then "Elevate," takes out the coin, throws back depression chock and sees the gun laid square between the housing-bolts; 2 prepares the train-tackle, and superintends bousing taut the frappings under 1; 3 and 4 put in the tompion and pass the muzzle-lashing; 5 and 6 render the breeching through the clinch, clap on the quarter-seizings, pass the frapping-turns ready for bousing, and prepare the side-tackles for frapping and securing; stationary powderman returns the powder, and the extra one swabs the deck.

NOTE.—No. 1 attends the inner block of the train-tackle and hooks on to the lashings, 7 overhauls it; 2 takes the large coin under the breast of the gun and remains there to pass the ends of the lashings.

METHOD OF PASSING THE LASHINGS.

The muzzle-lashing is spliced into the after eye-bolt, four turns are passed from in, out, towards the ship's side, and a half-hitch taken round all the parts close up to the after eye-bolt; the end is expended in frapping-turns down towards the muzzle, boused well taut, and stopped.

The breast-frapping is rove with a running eye round the after-part of the breeching, about 18 inches from the horns of the carriage; three turns are passed over the breeching forward, and under aft, towards the carriage, and boused well taut; then three turns over the gun, hauled hand taut and frapped, commencing close up to the gun; the end is expended in frapping-turns, down towards the breeching, boused well taut, and stopped.

The side-tackles are hooked to the side-loops in the carriage and the side-tackle bolts in the ship's side, hauled hand taut and hitched to their own parts, about a foot from the horns; the foremost fall is passed under the after side-tackle, and over the foremost one towards the ship's side, and boused-well taut; the after fall is passed towards the carriage, hauled hand taut, and stopped.

The train-tackle is hooked on the foremost side of the gun, to the rear loop in the carriage, and to the side-tackle bolt in the ship's side, hauled hand taut, hitched, and the fall passed as the after side-tackle; the coin is placed between the parts of the frappings.

NOTE.—The apron is immediately put on by 1, as the lock is very liable to be injured by the train-tackle fall in securing. The tompion is not to be put in till the guns are laid in the housing position, and no man is to pass his arm over the muzzle of the gun till it is so placed. No. 1 is answerable that the gun is not let down into the housing position, while there is risk to any man, from being between its muzzle and the upper port-sill.

Great care must be taken that at least 2 inches of the faces of the muzzles of all guns, house against the ship's side.

When the gun is secured, the Captain of the gun must examine all the implements, and report particularly to his Officer the state in which he finds them. That Officer is to cause every deficiency to be made good, and see that all the implements are carefully replaced in the different situations, ready in all respects for further use, when wanted.

N.B.—During the Second Instruction the men should be put through the 1st part of the Pointing Practice, and should also fire from a boat in motion.

THIRD INSTRUCTION.

REMARKS ON THE DIFFERENT FIRINGS.

INDEPENDENT FIRING.

By this is meant, firing the guns independently of each other, each Captain of a gun seizing the most favourable opportunity. This firing should always be used in Action (unless ordered to the contrary) whenever the object is visible, the smoke from one gun not greatly impeding the firing of another.

(See Detail for Independent Firing.)

FIRING IN SUCCESSION.

By this is meant, firing one gun after another in regular order, commencing from the foremost or after gun, according as the wind is blowing from *aft* or *forward*. This firing may be used with advantage, whenever a *continuous steady fire* is desired, as the smoke from one gun will not impede the firing of the next.

QUICK FIRING.

By this is meant, rapid independent firing, the tangent sight not being raised. This firing should be used when close alongside an enemy, as then but little pointing would be required.

(See Detail for Quick Firing.)

BROADSIDE AND DIVISIONAL FIRING.

By this is meant, firing the whole broadside or a division of guns simultaneously, by order. Broadside firing should be used

when the smoke hangs about the ship for some time, and Divisional firing when the smoke clears away at shorter intervals, as then the fire would be more continuous. Broadside or divisional firing could also be used with greater advantage within a moderate distance against stone forts than independent firing, from the increased concussion caused by a number of shot striking at the same moment. In divisional firing each deck, or the half of each deck, should be considered as a division according to circumstances.

(See Guide on Drilling Quarters, page 97, as to the mode of conducting this firing.)

CONCENTRATED FIRING.

By this is meant, firing guns previously laid by the aid of lines or battens, so that the shot may cross each other at a given distance. This firing would be most effective in case of smoke or darkness, the object being visible from the upper deck or mast head, and may be used at distances within and beyond the point of concentration, but the latter must never exceed double that, at which the shot cross.

(See Instructions for Concentrating, page 30.)

DETAILS.

IN INDEPENDENT FIRING,

No. 1 raises the tangent sight according to the charge and distance named, lays the gun for the object, and gives the word "Ready" as soon as the elevation is correct, keeping the direction on with the handspikes, and taking care not to fire till the side tackle falls are clear.

NOTE.—The gun is to be sponged and loaded without orders, and when the distance remains the same, the bed and coin should be chalked, after the gun is once carefully laid; by this means time will be saved in firing, as 2 will replace the coin to the chalk mark whilst the gun is being loaded, and No. 1 will fire when the motion brings the object on with the points of the sights; but if the heel or distance should alter, the gun must be relaid by sight.

In action or exercise the guns are to be *wormed* every 4th round, and *invariably* to be loaded and run out after the last round, unless ordered to the contrary.

IN QUICK FIRING,

No. 1 sees the gun laid horizontal and run out for the object, primes as the gun goes out, taking care not to cock the lock till the muzzle is clear of the port-sill, and not to fire till the side-tackle falls are out of hand.

The only words of command to be given are, "Run in," "Run out," and "Ready." 2 chalks the bed and coin, and the guns are relaid whilst loading.

NOTE.—But if the object is before or abaft the beam, and the gun cannot readily be run out for the object, No. 1 is to give the word "Point" in order to get the direction on, before giving the word "Ready," falling back with the lock half cocked.

The gun is to be sponged and loaded without waiting for orders, and the rear Nos. are to coil the side-tackle falls in their hands as the gun goes out.

LOWER DECK EXERCISE.

Before commencing, the guns should be run in, and the ports lowered.

In Lower Deck Exercise No. 1 sees the gun laid horizontal and square in the port, primes as the gun goes out, taking care not to cock the lock till the word "Trice up," and not to fire till the port is clear of the explosion; 2 attends the port-tackle fall; 3 and 4 shift the side-tackles to the quarter-bolts.

At the word "Trice up," 2, 7, 8, 9, and 10 haul up the port, 3 and 4 bear it out with the handspikes. The side-tackle falls are kept in hand till the word "Ready," the rear Nos. keeping the ends coiled up; when the gun is in, *both* rear-men who attend, hitch the train-tackle. 2 chalks the bed and coin, and the guns are relaid whilst in (*first for the scuttle, and after the gun is loaded, horizontal*).

NOTE.—As "Lower Deck Exercise" is meant for working guns in a sea with much motion, the Rear trucks should be taken off and the side-tackles hooked to the quarter-bolts to steady and train the guns. When the gun has recoiled, and the port is lowered, 1 trains the gun to admit of the staff-sponge being used through the scuttle. If the order is given "With staff-sponge, Sponge," 3 (at the

caution "*With staff-sponge*") opens the scuttle, taking care to close it when the gun is loaded. As soon as the gun is relaid, No. 1 gives the word "*Haul taut*" when the gun is to be run out till the muzzle is close to the port; he then waits for the order "*Trice up,*" and fires when the port is clear, without running the gun *further out*. 9 and 10 assist with their handspikes in running out, then pass them to 3 and 4 and man the port-tackle fall.

When the rope-sponge is used, 6 holds it, with the sponge-head in his *right* hand, and rammer-head in his *left*. On the sponge being withdrawn by 4, 6 passes the rammer-head on his left, and behind him, so as to hold the rammer-head in his *right* hand, and sponge-head in his *left*, ready for 4 to use the rammer in loading. *Both* rear-men are to attend the train-tackle, and the end of the fall is to be rove up through the train-tackle bolt on the opposite side of the deck when practicable.

When clearing for action "*Lower Deck Exercise,*" the gun is to be run in to a taut breeching, and the train-tackle hitched, before elevating.

The above exercise is only applicable to close action in a sea way.

ARRANGEMENT FOR FIGHTING BOTH SIDES.

When necessary to fight both sides, the whole of the guns are to be manned and worked with "*Half crews*" (as in Casting loose); but if from casualties or other causes this is not practicable, the Right guns should be left *in* after the first round, and the Left guns manned and worked with whole crews.

NOTE.—In action or exercise, the working with "*Half crews*" should not be continued beyond 3 or 4 rounds, as after this, owing to casualties and the fatigue of working on this plan, the firing would be more efficiently kept up by working every other gun.

SECURING A GUN FOR NON-RECOIL.

In close action, and when the crews are so reduced as not to be able to work the guns in the usual manner, it may sometimes be advantageous to fire the guns secured as follows:

Run the gun out so as to bring the muzzle over the centre of the lower port sill, and shorten the breeching up to this position; then run the gun taut in, and hitch the train-tackle, take off the rear-trucks, pass the breast frapping round the breeching as taut as possible, and chock the fore-trucks before all. The side-tackles are not required.

The muzzle of the gun, when in its proper position for firing, should be about flush with the inner part of the port, the gun is then laid horizontal and fired. After every three or four rounds, the train-tackle should be re-secured, or the breast frapping re-passed, so as to keep the breeching perfectly taut.

It has been proved that a gun may be loaded and fired on this plan with reduced charges and single shot without injury to the breeching, and that three or four men, for the heaviest description of guns, are sufficient.

SHIFTING BREECHINGS.

SHIFT
BREECHINGS.

Nos. 9 and 10 hitch the side-tackles; right rear-man the train-tackle; 3 and 5, or 4 and 6 take off the seizing, cast off the hitch, open the clinch, and unreeve the breeching; 2 and 11 bring the spare breeching up to the side of the port, opposite the old clinch, reeve it through the breeching-ring, through the clinch, and point the end through the neck-ring; handspikemen and rear-men haul it through. 1 sees the breeching properly secured, and takes care that his gun is so placed as not to interfere with the training of adjacent guns.

SPONGE, LOAD,
AND SHIFT
BREECHINGS.

Nos. 3, 4, 5, and 6 sponge and load, and 7, 8, 9, and 10 take their duties in shifting breechings, whilst so employed.

NOTE.—The breechings are to be rove with an *inside* clinch from right to left, if with a *left*-handed rope, and the reverse with a *right*-handed rope. As soon as the end of the spare breeching is rove through the opposite ring-bolt, No. 1 gives the word "Run out," to bring the muzzle over the inner part of the sweep piece, so that 3 or 4 may form the hitch; when the hitch is formed, No. 1 again gives the word "Run out," and lays the gun for the object, taking care not to fire till 3 or 4 indicate that the seizing is secured.

EXTREME TRAINING.

EXTREME TRAIN,
MUZZLE RIGHT.
(OR LEFT.)

Nos. 3 and 5 (or 4 and 6) shift the side-tackle to the bolt of the next port; 6 keeps sponge, rammer, and worm in a line with the gun, right rearman the train-tackle, handspikemen assist with their handspikes; the rest of the Nos., except 3 or 4, man the right or left side-tackle.

NOTE.—No. 3 or 4 should give a signal with the hand when the side-tackle is hooked.

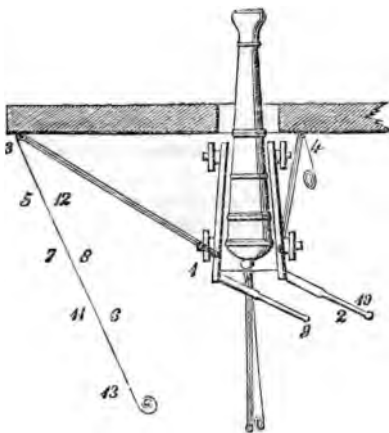
SQUARE
THE GUN.

Nos. 3 and 5 (or 4 and 6) shift the side-tackle to the quarter bolt; 6 keeps sponge, rammer, and worm in a line with the gun, right rearman the train-tackle, handspikemen assist with their handspikes; the rest of the Nos., except 3 or 4, man the right or left side-tackle; 1 looks out till the dispart is on with the centre of the port, and gives the word “Well,” “Muzzle right” (or left).

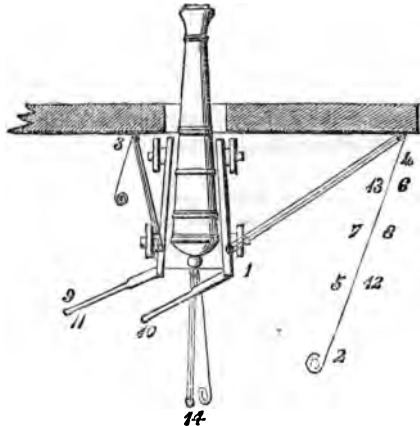
NOTE.—In squaring the gun, 1 is to take up a position *abreast* of the port, to enable him to bring the dispart on with the centre of it. In extreme training or squaring the gun, No. 1 renders the breeching about 18 inches through the span and neck-ring, the left rearman or No. 2 coils up the side-tackle fall, and at the word “Well,” gives it to 7 or 8, who puts it on the deck after the side-tackle is shifted back, the gun is then relaid, if necessary.

STATIONS FOR EXTREME TRAINING.

“Muzzle Right.”



“Muzzle Left.”



INSTRUCTIONS FOR A SIMULTANEOUS CONCENTRATED FIRE.

*“The lines should always be hooked on at the ports
directly after casting loose.”*

The Bearing, Heel, and Distance, having been given from the upper deck, the Officers of the different divisions of guns will name the elevation or depression to be given by marked coin (allowing for the distance and heel), together with the bearing, and then give the order “Lay the guns;” on which the Nos. 1 are to give the orders for training, holding the lines *immediately under* the marks overhead, denoting the bearing, and the guns are to be trained till the sights are *parallel* to the lines: Nos. 1 then give the word “Elevate” and direct 2 to give the guns the required elevation or depression, making the lines *fast* to hooks overhead; they then resume the trigger lines, and wait steadily for the orders “Ready,” “Fire,” which are to be given by the Officer attending the Director.

NOTE.—A person should be stationed at the tube on the upper and gun decks, to report when the guns are *laid*, and to repeat the orders to the quarters. (See Disparting Instruction on Concentrating, and the use of Moorsom's Director.)

The above method of laying guns could be used with advantage for *directing* the fire of *single* guns, so long as the *distance* is known and the ship remains steady on any one bearing; the only orders required from the upper deck would be the *distance* and *bearing*, as the Officers of the different divisions would note the *heel* by pendulum, and name the elevation or depression and bearing as before; the guns could then go on firing independently of each other.

Or when rolling past the centre, the Nos. 1, if properly trained, might be allowed to judge when the ship came on an even keel and fire accordingly, but the latter should only be attempted at short distances.

DISMOUNTING AND MOUNTING.

DISMOUNT
THE GUN.

No. 1 gives the word "Run in," then "Elevate," takes out the coin, throws back depression chock, and sees the gun laid square between the housing-bolts; 2 prepares the train-tackle, hooks it to the runner, and lowers the gun; 3 and 4 pass the muzzle-lashing; 7 and 8 take out the keys, throw back the cap-squares, unhook the side-tackles, and see the carriage clear; rear-men provide and hook the runner.

When the muzzle-lashing is passed, 1 gives the word "Dismount," and all the Nos. man the train-tackle, except 1, 3, 4, and the handspikemen; 3 and 4 remain at the muzzle-lashing until all parts bear an equal strain; handspikemen assist until of no further use, and then go to the train-tackle.

MOUNT
THE GUN.

{ Everything will be replaced by the same Nos.

NOTE.—When ordered to "*Dismount*," No. 1 makes up the trigger-line round the lock, attends the coin to assist the handspikemen, leaves it on the bed ready for mounting, and when the gun is high enough, gives the order "Well! Run the carriage back," he then replaces the depression chock.

SECURING WITH A DOUBLE BREECHING.

The spare breeching is rove through the spare ringbolt on the side of the port, opposite the clinch of the standing breeching; the end passed up between the side-tackle and bracket on one side, then under the cascable, and down between the side-tackle and bracket on the other side, and secured to the other spare ringbolt, taking the after side-tackle fall for a frapping, and the train-tackle to bouse it taut; the train-tackle is then hooked as in securing inboard, and the fall passed round the after part of the spare breeching, instead of round the after side-tackle.

SECURING WITH A STOUT HAWSER.

One end is lashed abaft to one of the spare ring-bolts in the ship's side, the bight passed under the cascables of all the guns, set up hand-taut forward and lashed; the train-tackles are hooked to the quarter-bolts between every two guns, and to a strop round the hawser; the falls manned and boused taut together, the ends expended round the hawser and through the quarter-bolts.

INSTRUCTIONS FOR THROWING LOWER-DECK GUNS OVERBOARD, WITH 20 MEN TO EACH, OR UPWARDS.

No. 1 provides a short strop, to be placed under the neck of the gun; 9, 10, 11, and 12, two capstan-bars, and attend them; 3, and 4 attend port lanyards. When cast loose, lay the gun horizontal, and ease it out, so that the muzzle may be just clear of the inside of the port.—Two side-tackles are to be hooked to the strop under the neck, and to the housing-bolts, hauled well taut, and kept manned; 7 and 8 throw back the cap-squares, and then, with 2, man the port-tackle falls. A train-tackle is to be hooked to each rear loop, and to the train-tackle-bolt in the deck, hauled taut, and attended by 17, 18, 19, and 20. The breeching is to be unrove. When ready, 1 looks out for the roll, and gives the order "Heave and haul;" when the side-tackles are hauled upon, the capstan-bars hove upon, and the carriage eased out by the train-tackles; the port being hauled up at the same time. When the gun is clear, the port is to be barred in. The capstan-bars are used with the small ends under the gun.

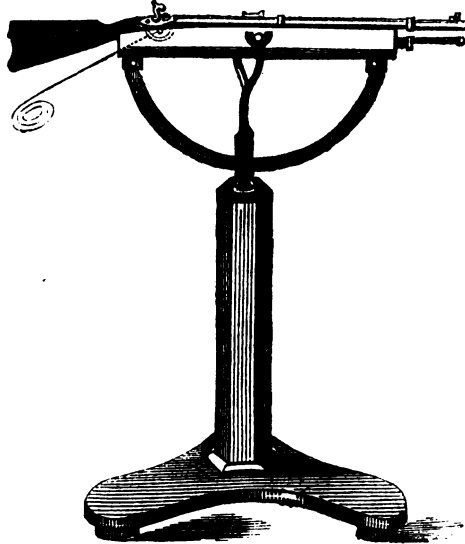
NOTE.—In case of a ship getting on shore, and it being necessary to throw the guns overboard to lighten her, the breechings could be used for weighing them, by securing the clinch to the button, and lashing the breeching to the chase, using the breast frapping as a buoy rope, with a truck for a buoy.

POINTING PRACTICE.

1ST.—RIFLE IN REST.

For this purpose a Rest should be fitted as in Diagram, capable of holding the Sea Service Rifle.

The man under instruction should be made to adjust the sight for every 50 yards, and point at some fixed object on shore, or at marks painted on the ship's side, holding the butt at the full extent of the left arm, and the trigger - line in the right hand ; another man should raise or lower the breech after the word "Elevate," and attend the screw, ready to clamp the arc at the word "Well." The man pointing should then step aside, to enable the instructor to see whether the aim is correctly taken. After the men are perfect, they should fire a certain number of rounds from the same *rest*, at targets distant from 200 up to 800 yards, and afterwards at a moving target towing astern.



Total Height, 5 ft.

2ND.—LEVER TARGET.

1. Practice in firing without motion.
2. " " with pitching motion.
3. " " with rolling motion.
4. " " with pitching and rolling motions combined.

NOTE.—The learner to be kept at this instruction until he can make five hits out of seven shots in three minutes, the lever target being in double motion.

Any convenient gun may be run in and placed fore and aft for this purpose.

REVOLVING GUN EXERCISE,**WITH A CREW OF 17 MEN AND UPWARDS.**

THE crew are assembled as in the established gun exercise.

Gun Nos. 1, 2, 3, 4, 5, 6.

Auxiliaries, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, &c.

Traversing-tackle-men, 7, 8.

Handspikemen, 9, 10.

Assistant handspikemen, 11, 12.

Compressor-men, 13, 14.

Rear-men.—16, the right rear-man; 17, the left rear-man
(or the two highest Nos).

- | | | |
|-----------------|-----------------------|----------------------|
| 1. The Captain. | 3. Loader. | 5. Assistant Loader. |
| 4. Sponger. | 6. Assistant Sponger. | 2. Second Captain. |

PROVIDING STORES.

No. 1. Provides 3 vent-plugs, priming wire, tube-box, spare trigger-line, vent-bit, sees the lock fixed and fit for use, and places handspikes.

2. Assists 1.

3. Shot-grummet, spare breeching, wet swabs, wads, and fuze-wrench.

4. Shot-grummet, spare breeching, fire-bucket, and two stop handspikes.

5. Bearer, and shot.

6. Sponge, rammer, worm, and shot.

Stationary and extra powdermen, two cartridge-cases, and two cartridges each.

NOTE.—Spare locks and hammers are to be provided by the 2nd Captain; Axletrees and trucks by 11 and 12.

Shells are always to be provided by the two highest Nos.

When Pivot guns are mounted as broadside guns and only *one* crew can be allotted to *two* guns, the "Stores" should be provided with "*both sides manœuvred*," as laid down in First Instruction.

EXERCISE WITH 17 MEN.

No. 1. The Captain; commands, attends the breeching, primes, points, fires, and stops the vent.

2. The Second Captain; assists 1, runs out, attends the apron, coin, lock, and rear-bolt.

3. Loads, rams home, runs out, attends fighting-bolt, shackles and unshackles breeching.

4. Worms, sponges, rams home, runs out, attends stop-handspike, shackles and unshackles breeching.

5. Brings up shot or shell, runs out, traverses, and spans the breeching.

6. Gives sponge, rammer, and worm to 4, runs out, traverses, and spans the breeching.

7 and 8. Run out, attend traversing-tackles, and shift side-tackles.

9, 10, 11, and 12. Run out, and attend handspikes.

13 and 14. Run out, traverse, and attend compressors.

15. Runs out, and traverses.

16. Traverses, shifts traversing-tackle, attends stop-handspike and train-tackle.

17. Traverses, shifts traversing-tackle, brings up shot or shell, and attends train-tackle.

NOTE.—These Nos. will be reduced for lighter, or increased for heavier guns, as may be necessary, when the rearmen will do the duties of 16 and 17. With less than 15 men, Nos. 11 and 12 will attend compressors.

When slide guns are fitted with Ferguson's Compressor, No. 8 is to attend it.

Stations for Casting Loose a Revolving Gun.

1 and 2 place handspikes and provide stores; 3, 4, 5, and 6, provide stores and clear away side-tackles; 7, 8, 16, and 17, clear away and hook on traversing-tackles to fore part of slide; 9, 10, 11, and 12, clear away spans, and unscrew span shackle-bolts; 13, 14, 15, 16, and 17, clear away the ports and berthing. When the gun is clear, No. 1 gives the word "Action on the fighting-bolt * * * " "Right (or Left), Traverse," and when on the fighting-bolt *named*, "Well," the gun is then searched, loaded, and run out. While the gun is being searched, the breeching should be shackled to the ship's side.

*Stations for Casting Loose a Broadside Pivot Gun**(both sides manned).*

No. 1 places handspikes and provides stores; 3 and 4 provide stores and clear away side-tackles; 5 and 6 clear away spans, and unscrew span shackle-bolts; 2, 7, 8, and 9, clear away and hook on traversing-tackles, and unship ports and berthing. When the gun is clear, No. 1 gives the necessary orders for getting it on the fighting-bolt; the gun is then searched, loaded, and run out. While the gun is being searched, the breeching should be shackled to the ship's side.

WORDS OF COMMAND.

"Traverse."

"Prime."	"Ready."	"Sponge."
"Point."	"Fire."	"Load."
"Elevate."	"Stop the vent."	"Run out."

NOTE.—When the direction of the gun is to be altered, the word "Traverse" is to be given if the gun is *in*, and "Point" when the gun is *out*.

RIGHT
OR LEFT
TRAVERSE.

The handspikemen pick up their handspikes; 7, 8, 16, and 17 shift the traversing-tackles, if necessary; 5 and 6 shift (for running out), haul taut, and hitch the side-tackles, and place the falls on the slide. All the Nos. man the *right or left traversing-tackle*, except 1, 6 who keeps sponge, rammer, and worm in line with the gun, 7 or 8 who attend the opposite traversing-tackle, and the handspikemen. At the word "Well," the Nos. go to their respective sides, and the handspikemen ground their handspikes.

PRIME.

No. 1 opens the tube-box with his left hand, takes out a tube with his right, and primes.

POINT. { No. 1 retires to the full extent of the trigger-line, leaning well over on his right knee, keeping his left foot clear of the recoil. The handspikemen pick up their handspikes, keeping them clear of the slide; the assistant-handspikemen double into them, and the rest of the Nos. (except 2, 3, and 4) man the traversing-tackles.

In extreme training, all the Nos. man one traversing-tackle, except those before-named, 6 who keeps sponge, rammer, and worm in line with the gun, and 7 or 8 who attend the opposite traversing-tackle.

ELEVATE. { The handspikemen place their handspikes on the steps of the carriage, under the breeching, and raise the gun off the coin; 2 steps in with his left foot in a line with the gun, keeping his right clear of the recoil, and withdraws the coin to the full extent; handspikemen lower the gun slowly and steadily; at the word "Well," 2 forces in the coin, and when he feels the weight of the gun, gives the word "Down" to the handspikemen, springing up to the safety position on the right.

NOTE.—3 and 4 raise the breeching, and assist the handspikemen. The word "Ready" is to be given as soon as the elevation is correct, and the pointing continued until the word "Fire."

READY. { No. 2 steps up to the right of the gun, clear of the carriage, cocks the lock with his left hand, and retires. The rear-men attend the train-tackle.

FIRE. { No. 1 fires with a suitable jerk, springing up to the safety position on the left; handspikemen ground their handspikes; traversing-tackle-men haul taut, and hitch their tackles.

STOP THE VENT. { No. 1 makes up the trigger-line hand over hand, lays it across the neck-ring, forces in a vent-plug with his left hand, keeping his thumb on it, and fingers extended along the vent-field; half cocks the lock with his right hand.

RUN IN. { All the Nos. man the side-tackles, except 1, and 3 and 4 (who shift the side-tackles, and attend the breeching), compressor-men slacken the compressors. When the gun is in, 1 gives the word "Well", and 7 and 8 shift the side-tackles.

NOTE.—In running in a lee gun with much heel, it will be requisite to man the train tackle as well as the side-tackles; 11 and 12 assist 7 and 8 to shift the side-tackles.

SPONGE. { Nos. 3 and 4 step on the slide together, 3 with his right leg, 4 with his left; 6 faces outwards, and takes up the sponge with his right hand over and left under, and gives it to 4, who receives it in the same manner, *forces it hard home to the bottom of the bore in two or three motions*, gives it two round turns, withdraws it hand over hand, gives it two smart taps under the muzzle, and lays it quietly across the breeching; 6 returns it and takes up the rammer.

LOAD. { No. 3 receives the cartridge from the powderman facing inboard, and enters it seam sideways and bottom first, to the full extent of his arm; 5 and left rear-man place shot and wad on the slide; 3 and 4 enter them; 4 receives the rammer from 6, with his right hand under and left over, and assisted by 3, forces all home together, hand over hand, giving them two smart blows; they then quit the rammer, while 1 pricks the cartridge to ascertain if it is home, and gives notice to 4; 3 faces the ship's side, 4 springs the rammer and lays it quietly across the breeching, 6 returns it; 3 and 4 step off the slide together, 5 and 6 throw the side-tackle-falls to the rear.

NOTE.—The shot are to be brought up on a bearer. With 10-inch shell, 5 and left rearman bring up the shell in the box to the left of the gun, and place it on the slide under the muzzle; 3 takes off the top of the box, 3 and 4 lift the shell by the box handles, 3 with his right hand, 4 with his left, and place the shell in the bore, fuze outwards; 3 takes off the cap of the fuze and passes it to 1 (as a security that the fuze has been uncapped), 4 immediately covers the fuze over with the rammer-head, and assisted by 3, forces home shell and cartridge.

The cap is never to be taken off until the shell has been entered a short way into the bore; with high elevations, or when rolling, care should be taken that the shell does not slip down the bore before this is done.

The fuzes of percussion shells have no caps; these shells are brought up as before, entered fuze outwards, and rammed home as a shot.

RUN OUT. { All the Nos. man the side-tackles except 1 and both rear-men, who attend the train-tackle; when the gun is out, 5 and 6 coil down the side-tackle falls, compressor-men set taut the compressors.

TO SHIFT FROM THE REAR-BOLT TO A FIGHTING-BOLT.

ACTION ON THE FIGHTING-BOLT. { If the gun is out, No. 1 gives the word "Run in," then "Right or left traverse," 3 attends the fighting-bolt, 4 the stop-handspike; when the bolt is keyed, 3 gives the word "Well," and 1 the word "Run out," traversing-tackle-men shift their tackles, and 2 takes out the rear-bolt.
* * * *

TO SHIFT FROM A FIGHTING-BOLT TO THE REAR-BOLT.

ACTION ON THE REAR BOLT. { If the gun is in, No. 1 gives the word "Run out," then "Point," "Muzzle right or left." 2 attends the rear-bolt, right rear-man the stop-handspike; when the bolt is keyed, 2 gives the word "Well," and 1 the word "Run in," traversing-tackle-men shift their tackles, and 3 takes out the fighting-bolt.

NOTE.—Should the gun require much training to get it on the rear-bolt, No. 1 gives the word "Square the gun," instead of "Muzzle right or left."

TO SHIFT FROM ONE FIGHTING-BOLT TO ANOTHER.

ACTION ON THE FIGHTING-BOLT. { If the gun is in, No. 1 gives the word "Run out," then "Point," and proceeds to get the gun, *first* on the rear-bolt, and *then* on the fighting-bolt required.
* * * *

TO SECURE THE GUN.

No. 1 sees that *both* bolts are in, and the gun run in; gives the word "Elevate," and withdraws the coin; 2 superintends bousing taut the frappings under 1; 3 and 4 put in the tompon; 3, 4, 5, and 6 hook and haul taut the side-tackles; 7 and 8 hook the right traversing-tackle; 16 and 17 the left; both of which are hauled taut and frapped; handspikemen assist with their handspikes, and compressor-men set taut the compressors.

The side-tackles are hooked to the rear loops in the slide, hauled taut, and hitched to their own parts, about a foot from the horns of the carriage; the ends are expended in frapping-turns, which are passed *over* and *under*, the right side-tackle being passed *from* the horns of the carriage, and the left *towards* them.

The left traversing-tackle is passed over the gun a little before the vent-patch, and hooked to the span-shackle-bolts in the deck, hitched to its own parts on the *left* of the gun, and the end expended in frapping-turns between the carriage and slide, hauled well taut, and stopped; the gun is then elevated, and the coin forced well in.

The right traversing-tackle is passed over the gun about a foot from the horns of the carriage, and hooked to the span-shackle-bolts in the deck, hitched on the *right* of the gun, and the end expended in frapping turns, commencing close up to the gun, down towards the slide, boused well taut, and stopped.

SECURING WITH SPANS AND PENDANTS.

The spans are passed over the gun just before the traversing-tackles, and set up with lanyards to span-shackle-bolts in the deck. There are four pendants fitted to go round the gun. Those near the breech are rove with a running eye round the gun, and set up with lanyards to span-shackle-bolts in the ship's side. Those near the horns of the carriage are fitted with large eyes to go over the muzzle, back to the span, and set up in the same manner. The pendants are then further secured by frapping them together.

NOTE.—When securing with spans and traversing-tackles, at the same time, the gun should not be elevated until the *rear* span and the *left* traversing-tackle are secured. 9, 10, 11, and 12 screw in span-shackle-bolts, and provide the spans. The pendants are only intended to be used in bad weather.

TO TRANSPORT THE GUN.

First, run in and ship the fore axletree and trucks, secondly, run out and ship the rear axletree and trucks, and then run the gun in to the centre of the slide ; or ship the fore trucks only, and run out, so as to bring the weight of the gun chiefly on the fore-trucks, using a large roller handspike in rear of the slide.

NOTE.—Guns should never be transported when loaded, and in all cases of traversing with the *muzzle inboard*, the tube should invariably be taken out and the vent-plug put in.

If roller handspikes are used, 1 and 2 provide and use them.

TO DISMOUNT THE GUN.

No. 1 directs the four rear numbers. to place the inclined planes in rear of the slide, and then gives the word “Run in;” 3 and 4 unshackle the breeching and lay the ends across the chase ; 5 and 6 shift the side-tackles to the rear, to bouse the gun off the slide ; 7 and 8 hook the traversing-tackles to the breast loop in the carriage, to ease the gun off the slide ; 9 and 10 assist with their handspikes ; 11 and 12 ship the axletree and trucks ; 13 and 14 take off the compressors, and 1 and 2 the levers.

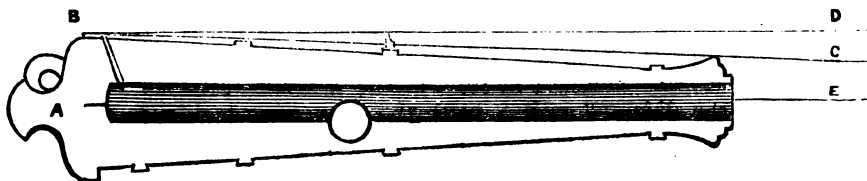
NOTE.—When dismounted, the gun can be worked as a broadside gun, using a roller handspike to run out with.

FOURTH INSTRUCTION.

USE OF SIGHTS, &c.

A TARGET should be placed on the deck, 20 yards from the gun, having three distinguishing marks upon it, viz: one for the line of dispart, which should be the same height from the deck as the dispart of the gun; one, 2 feet above it; and one for the axis of the piece, when the gun is laid by line of metal for the lower mark.

NOTE.—A wooden gun with a hole bored through it in the direction of the axis, will facilitate the teaching of this Instruction.



Q. What does the diagram show?

A. It shows the form of a gun inside, that the bore is the same size throughout from breech to muzzle, but the gun is not so outside, and thereby points out the necessity of placing a dispart on the gun, to give a line of sight parallel to the centre of the bore. Also the direction of the vent, and if firing with a match, the necessity of holding it before the vent to prevent the explosion blowing it out of the hand.

Q. What is the calibre of a gun?

A. The diameter of the bore.

Q. What is the axis of the piece?

A. Centre of the bore lengthways, as A E.

Q. What is meant by line of metal?

A. A line drawn from the notch on the top of the base-ring to the notch on the top of the swell of the muzzle, as B C.

Q. Point the gun by line of metal, and prove that the shot will go above the object?

A. The shot will go above, as the standard shows that the centre of the breech is nearer the deck than the centre of the muzzle; but it would strike an object when the distance requires line of metal elevation, which is $1\frac{1}{2}^{\circ}$ in the old pattern, and $2\frac{1}{4}^{\circ}$ in the new pattern guns.

Q. What is a dispart?

A. A dispart is a piece of metal placed on the top of the gun, to give a line of sight parallel to the centre of the bore, as B D.

Q. How is a gun disparted?

A. By taking the circumference of the base-ring and of any other part of the gun where the dispart is to be placed; take the less from the greater, and one-sixth the difference will be the height of the dispart nearly, to which must be added the height of the top of the tangent-sight above the base-ring.

Q. What is meant by laying a gun point blank?

A. Pointing at an object with the tangent-sight close down.

Q. What is usually called P. B. range by British Artillerists?

A. The distance from the gun when laid horizontal, 8 feet above the plane, to the first graze of the shot.

Q. If the gun is pointed by dispart at an object, at what is termed the P. B. range, would the shot strike the point aimed at?

A. No; it would strike below or fall short, as the weight of the shot causes it to fall, from the moment it leaves the gun.

Q. Lay the gun P. B. by dispart, for the bull's-eye in the target, and prove it so?

A. The gun is now laid P. B. by dispart, and the bore is parallel to the deck, as the standard shows that it is the same height from it at breech and muzzle.

Q. How can a gun be laid without a tangent sight, that the shot may strike an object beyond P. B. distance.

A. It must be pointed by dispart, a certain height above the object, to allow for the fall of the shot during its flight; the height to be pointed above must depend upon the distance of the object.

Q. Would the object then be seen ?

A. No ; the muzzle of the gun would be between the eye and the object.



Q. How then can a gun be elevated, and the object kept sight of, at the same time ?

A. By raising the tangent sight to a height corresponding to what the muzzle is raised above the P. B. position.

Q. Show practically the use of the tangent sight ?

A. The person under instruction should here show and explain the use of the tangent sight as under :

Example. Suppose the lower spot in the target to be an object so distant as to require 2° elevation ; the upper spot is 2° above it, therefore, when the gun is laid by dispart for the upper spot, the bore is elevated 2° above the object ; but as the muzzle and dispart are between the eye and the object, the tangent sight should be raised to a corresponding height, and then the tangent sight, dispart, and the object, will be seen in one. It is thus shown that by the aid of a tangent sight, it is as easy to point at objects so distant as to require elevation, as it is by dispart when near ; and that without it, the object is lost sight of, the instant the muzzle is raised above the P. B., or horizontal position.

Q. In pointing, what would be the consequence of not keeping the eye close down to the notch on the tangent sight, getting that, the dispart, and the object in one ?

A. The gun would have too much elevation.



Q. How should the sights be used at sea when there is motion, and the distance known?

A. The tangent sight should be raised for the distance and charge, and the gun laid, so that the points of the sights may pass above and below the object, and fired the moment it is brought on by the motion.

Q. If the ship alters her heel after the gun is laid for an object, what should be done?

A. No alteration should be made in the sights, as the distance remains the same, but the gun must be relaid for the object.

Q. How are guns laid horizontal in an open roadstead?

A. By pointing at the horizon with the sights at P. B.

Q. How are guns laid horizontal in a close harbour?

A. By pointing with the sights at P. B. at an object the same height above the water as the gun is.

Q. If firing at an object, and the charge is changed, what alteration should be made in the elevation?

A. From distant to full, $\frac{1}{4}^{\circ}$ more will be required up to 1000 yards, and $\frac{1}{2}^{\circ}$ more beyond that distance. From full to reduced, $\frac{1}{4}^{\circ}$ more will be required; but if the sight is marked in yards, it should be adjusted according to the *charge* named.

Q. Explain the use of the side-scale, standard, and marked coin.

A. They are used, in combination with a pendulum, for laying the gun, when the object is obscured by smoke or darkness.

NOTE.—Here the instructor should vary the charge, distance, and heel of the ship, until the person under instruction is thoroughly acquainted with the use of the side scale, standard, marked coin, and pendulum. He should also explain the difference between firing by tangent-sight and spirit-level, from different heights above the plane.

USE OF PROJECTILES.

Q. Under what circumstances should single solid shot be used?

A. Solid shot have a greater momentum than hollow projectiles of the same diameter, they should, therefore, be used where great penetration and accuracy are required.

NOTE.—Ricochet firing may be practised in smooth water, using $\frac{1}{4}^{\circ}$ elevation, and distant charges, and pointing at the object as in direct firing, but the penetrations against ships are very uncertain beyond 1500 or 1600 yards.

Q. At what distance should double-shot, or shot and shell, be used?

A. Not beyond 400 yards.

Q. What elevation should be given?

A. Double the elevation for single shot with reduced charge, always using reduced charges for double shooting; except in raking astern, when a full charge should be used.

Q. Under what circumstances should shells be used?

A. Shells should be used against ships, at all distances where the penetration would be sufficient to lodge them; they should not, however, be used for breaching solid stone walls, but would be very effective when fitted with time-fuzes, against earthworks, ordinary buildings, and for bombarding.

Q. Under what circumstances should Shrapnell shell be used?

A. Shrapnell shell may be used with great effect against boats and bodies of men at from 200 up to 1600 yards, from heavy guns with high charges; but not beyond 900 yards from a boat's light howitzer.

Q. What should be used instead, at shorter distances than 200 yards?

A. Common case, or if none are obtainable, Shrapnell shell, entered fuze inwards, which, from bursting in the gun, will have the same effect.

Q. At what distance should grape shot be used?

A. Not beyond 400 yards against ships, but it would be very effective against boats, or men exposed, up to 1000 yards.

Q. What elevation should be given ?

A. Grape shot ranges two-thirds the distance of round shot, ~~as far as 400 hundred yards~~; the gun must therefore be elevated for half more than the distance required.

Q. At what distance should case shot be used ?

A. Not beyond 300 yards against boats, or men when exposed; it is of little use against ships.

Q. What elevation should be given ?

A. Case shot ranges half the distance of round shot; the gun must therefore be elevated for double the distance required.

Q. What elevation should be given for double grape ?

A. The gun must be elevated for three times the distance required.

Q. What elevation should be given for double case ?

A. The gun must be elevated for four times the distance required.

NOTE.—It has been observed that grape and case shot always range closer together when fired with reduced charges; they are considered, however, of very little use against ships, as they will not penetrate through a ship's side; therefore, double shot is preferred to round and grape, but shot and shell is superior to either.

NOTE.—The instructor names the distance of an object, varying the gun, charge, and distance as required, and also explains every graduation of the tangent sight, until the person under instruction is thoroughly acquainted with every elevation it is capable of giving.

THE SERVICE CHARGES FOR THE FOLLOWING GUNS.

Nature of Gun.	Weight.	Length.	Charges.		
			Distant	Full	Reduced.
68-Pounder	cwt. 95	ft. in. 10 0	lbs. 16	lbs. 12	lbs. 8
10-Inch	84	9 4	12	..	..
8 "	65	9 0	10	8	5
8 "	60	8 10			
8 "	52	8 0			
8 " Carr. ..	36	5 4	..	5	..
32-Pounder	56 & 58	9 6	10	8	6
32 " A ..	50	9 0	..	8	5
32 " B ..	45	8 6	..	7	5
32 " C ..	42	8 0	..	6	4
32 "	32	6 6	..	5	3
32 "	25	6 0	..	4	2½
32 " Carr. ..	17	4 0	..	2lb. 10oz.	..
(The charge of all other Carronades is also 1-12th the weight of their shot).					
24-Pounder Howitzer	12½	4 8	2½	..	..
12 " " ..	10	4 6	2	..	..
12 " " ..	6½	3 9	1½	..	..

The 68-pr. and 32-pr. guns of 58 and 56 cwt. may be double shotted as far as 400 yards.
The "A" and "B" ditto ditto 400 "
The "C" guns ditto ditto 300 "
The 32 and 25 cwt. 32-pr. guns, and 8-in. 65 and 60 cwt. guns ... 200 "
Carronades, the 8-in. 52 cwt. and the 10-in. guns, are never to be double shotted.

Allowance for the Deflection of Shot occasioned by the Wind from a 32-pounder, 56 cwt., charge 8 lbs.

In firing with a moderate breeze (force 4) *across* the range, an allowance of 1 foot for every 100 yards of distance has been found a correct guide.

With a moderate gale (force 7) *across* the range, 2 feet for every 100 yards of distance. At 1000 yards distance with the latter force of wind (7) *against* the range, ¼° more elevation should be given; and when *with* the range, ⅓° less elevation, than in the Range Tables.

MAGAZINE INSTRUCTION.

ALL persons stationed to supply powder to the guns, *i. e.*, magazine-men, passage-men, ladder and scuttle-men, stationary and extra powdermen, should be frequently exercised, to ensure this duty being performed with rapidity and that a proper supply be kept up.

Should the number, from casualty, be deficient, the Officer in charge should immediately apply for aid to the Lieutenant of the deck on which the casualty occurs. When exercising at general quarters, dumb cartridges are to be handed up, and the delivery is to commence as soon as possible after the beat of the drum.

The extra powdermen are to be trained to stand in rank on arriving at the supply scuttle, in order that the guns may be fairly and equally supplied.

Should the expenditure of ammunition be from any cause more rapid on one part of the deck than another, the Officer of the deck will direct the extra powdermen of the unengaged guns to carry their supply where most needed.

The exercise should be continued fifteen minutes from the first box being handed up, and the supply from each handing scuttle should not be less than from fifteen to eighteen cartridges a minute.

In order to test the efficiency of the exercise, it is desirable that powder should occasionally be handed up to the extent, at least, of the number of leather cartridge-cases supplied.

The Officer charged with the superintendence of the supply of powder, is to be held responsible that no accumulation takes place either in the passages or within the screens; and also that the hatchway and scuttle-men are in their stations, and that silence is maintained.

ON STOWING AND WORKING MAGAZINES, &c.

Q. When the magazine is reported ready by the dockyard, what should be done?

A. Measure the distances between the stanchions to ascertain if there be sufficient space to stow the cases. Air the magazine with charcoal stoves, taking care that no one goes down while they are burning, nor afterwards, until a lantern and candle have been let down: if the candle should burn bright, it is safe; if dim, the magazine contains foul air; in which case send a windsail down to purify it.

Q. How may dampness in a magazine be discovered?

A. Let a sponge, soaked in a solution of salt of tartar, or common salt and water, be well dried and weighed, and then placed in the magazine; if it be damp, the sponge will become heavier.

Q. What precautions are necessary in embarking and disembarking powder?

A. To see that all lights are extinguished; that the ports and combings are covered with hides and swabs, and the deck with wadmiltits; that the men have magazine slippers on, and carry no knives.

Q. Describe the method of stowing the magazine.

A. In two-decked ships, in the fore magazine, the powder should be stowed on the port side for the lower deck, and on the starboard side for the main deck: in the after magazine, that for the upper deck, small arms and boats. In three-decked ships, in the fore magazine, the powder should be stowed on the port side for the lower deck, and on the starboard side for the middle deck: in the after magazine, on the starboard side for the main deck, and on the port side that for the upper deck, small arms and boats. The 32-pounder charges should be stowed in the midship passages, and the 8-inch charges in the wing passages; the reduced charges being nearest the doors, the full next, and then the distant. The spare powder should be stowed so as not to interfere with the general working of the magazine.

NOTE.—The magazine is intended to be stowed on the above plan, when the number of 32-pounder guns on the deck exceeds that of the 8-inch guns, but if the latter are the more numerous, the powder for them should be stowed in the midship passages, and that for the 32-pounder guns in the wing passages.

When the number of either the 32-pounder or 8-inch guns on the deck is small, as compared one with the other, a proportion of the charges for both should be stowed in the wing passage, so that the supply may be regulated by the man stationed there.

When the guns on the deck are all of the same nature, the reduced charges should be stowed nearest the doors in both the passages, the full next, and then the distant, in order that powder may be supplied from both passages at the same time.

Other modifications may be found necessary, and must be regulated by actual practice.

Q. Where are the percussion tubes stowed?

A. In the gunner's store-room, under lock and key.

Q. Are the cases air and water tight?

A. Yes; they are made so by luting, which is a composition of bees'-wax and tallow, one part of the former to two of the latter; it is first put in the rebate, the bung is then put in, giving it half a turn, and an exterior coat of luting is placed over all. The luting should be examined every three months, and if necessary, taken off, softened in the hand, and replaced.

Q. What are the marks on the powder-cases and cartridges?

A. They are marked in full, according to the weight of the charge, and the nature of the gun, with black D for the distant, blue ball and F for the full, and red ball and R for the reduced. The cartridges are further distinguished by the number of worsted hoops—the distant having three, the full two, and the reduced one.

Q. What are the colours of the leather cartridge-cases?

A. For lower deck, white; middle deck, blue with a white stripe; main deck, red; upper deck, black, and marked "Upper deck." The cartridge-cases for the 8-inch guns are further distinguished by being marked "8-inch," and by having a Turk's head upon the handle.

NOTE.—The staves of the sponges, rammers, and worms for the different decks should be marked in a similar manner, viz. :—For lower deck, white or scraped; middle deck, blue, with a white or scraped centre; main deck, red; and upper deck, black.

Q. How are the men stationed in the magazine and handing-rooms?

A. Six men for each side of the magazine, and five for the handing-rooms on each side. In the magazine 1 at the return

Q. What precaution is necessary when filling flanne cartridges?

A. Great care must be taken that the tye of the cartridge does not project more than one inch; otherwise it would be liable to get under the shot, which would jam it in the bore, and prevent its being rammed home.

NOTE.—With 8-inch guns it is most essential that the reduced cartridges be filled up with dry sawdust, so as to make them *at least* 9 inches in length; without which the guns will frequently “miss fire” from the charge not being under the vent. Elm sawdust has been found to answer best. Should there be no sawdust, conical tops, made of cork or dry fir wood, $5\frac{1}{4}$ inches in diameter and $2\frac{1}{4}$ inches deep, should be substituted.

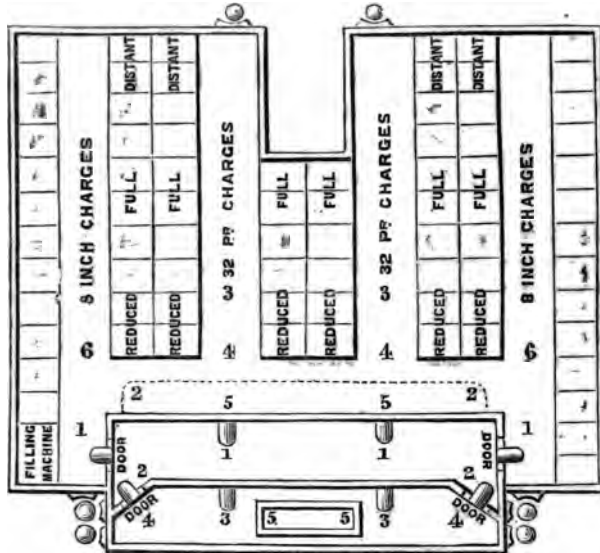
Cartridges with these tops are not to be used for saluting.

MEMORANDUM RESPECTING THE PRESERVATION AND USE OF DETONATING TUBES AND CAPS.

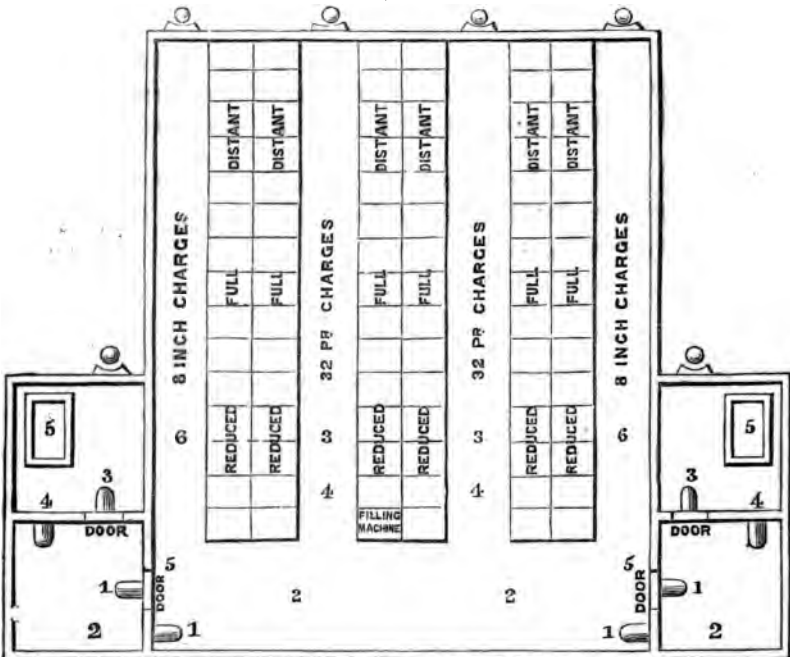
1st. Tubes and caps, when wanted for practice, that have been only a few days in the boxes on deck, should be slightly heated.

2nd. When required for actual service, those on deck should be set aside, and replaced by others from the store-room.

3rd. Complaints have frequently been made of the tubes, when the fault rested with the captains of the guns from not pulling strong enough.

Plan of a Line of Battle Ship's Fore Magazine (new pattern).

Dimensions.—Extreme length of Wing Passage, 17ft.; Breadth of Magazine, 26ft. 6in.; Height, 9ft. 6in.

Plan of a Line of Battle Ship's Fore Magazine (old pattern).

Dimensions.—Extreme length, 26ft. 3in.; Breadth of Magazine, 21ft.; Height, 7ft. 9in.

DIRECTIONS FOR THE USE OF SHELLS.

ALL loaded shells supplied to the Royal Navy are to be sent on board in boxes or in fuze covers.

A portion of the shells are loaded, and have one of the following fuzes fixed in them, viz : either the $7\frac{1}{2}$ sec. Time fuze, or Moorsom's Percussion fuze. Loaded shells are always to be stowed in the shell-rooms, with the exception of those required to be placed on the different decks.

Empty shells should be stowed in the lockers provided for them, and kept perfectly dry ; the fuzes remaining packed in their cases. After an expenditure of shells, the spare shells should be fitted for service, and placed in the empty boxes, to keep the shell-rooms at all times complete.

The time fuze-shell is to be pushed, not rammed home ; and if there is much motion, a grummet wad is to be used.

The time fuzes should be bored into at the hole corresponding to the time of flight, and screwed into the shells in some secure place appropriated for the purpose, *not in the shell-room*, and as far from the magazine entrance as possible ; this precaution also applies to *filling* shells.

In filling, care should be taken that the end of the funnel passes below the screw in the tap, to prevent any grains of powder from entering it ; but should they do so, they must be brushed out carefully. The proper bursting charge having been put into the shell, the fuze being first well brushed and luted, is then to be screwed in, and care should be taken to place the small parchment ring under the head of it, or something of a similar nature, to guard against accident ; the shells are then to be placed fuze downwards in the boxes, ready for use, and removed at once to the shell-room.

Shells for ships are fitted with wooden bottoms ; should the bottoms come off, a grummet of $2\frac{1}{2}$ -inch rope for the bottom of a shell, snaked to a grummet of good two-yarn nettle-stuff, has been found to steady the shell, and to prevent it from being turned in setting home.

It is necessary to exercise firing shells, but the number should

not exceed $\frac{1}{4}$ of the whole portion of shot allowed to be fired in exercise, and the shells so fired should be deducted from the allowance.

A proper proportion of fuze wrenches and implements for fitting fuzes, are supplied to each ship.

When it is necessary to examine the priming of a fuze, the shell is to be placed in the muzzle of a gun as in loading, the gun being previously loaded with a small charge of powder to blow it out in case of ignition; care should also be taken to see that the range is clear.

PARAPET FIRING.

It is sometimes necessary to fire with high elevations and small charges, for the purpose of giving an increased curve to the shell, with a view of dislodging men from behind embankments, and also for clearing broken and abrupt ground previous to landing troops.

(See Table of Ranges for this practice, page 109.)

The guns should be loaded in the following manner:—

1.—Before loading, give the guns the required elevation as nearly as possible, as it prevents the chance of the charge getting from under the vent, though in such a case it would only require a musket cartridge of powder poured down the vent, to ensure the gun being fired.

2.—For the 32 and 68-pounder guns, the charge is first set home, and afterwards the shell, but care must be taken not to force the shell *hard* home, otherwise it may force the cartridge past the vent, and the gun would then “miss fire;” to prevent this, the shell should be set home so as just to touch the charge, with the priming wire remaining in the vent, to prevent its shifting.

3.—For the 8 and 10-inch guns, the charge is first set home with a 32-pounder rammer, on account of the conical chambers, but the shell can be forced home as usual, as it will be brought up by the chamber before it can reach the charge.

Where the hammock nettings can be removed, shells in this practice can be fired from upper deck guns, quicker than in direct firing, as the guns need not be run either “in” or “out.”

ON FITTING FUZES, &c.

Q. Describe Boxer's $7\frac{1}{2}$ -second metal fuzes, and the mode of fitting them?

A. These fuzes are driven with mealed powder, and are distinguished by being marked M.P., and by having an indented red circle on the top of the cap: they can be used at all distances under 1900 yards, and are not to be *cut off*, but bored into at the hole corresponding to the flight required.

Q. Describe Boxer's 20-second metal fuzes, and the mode of fitting them?

A. These fuzes are driven with fuze composition, and are to be used for all times of flight beyond $7\frac{1}{2}$ seconds; they are not to be *cut off*, but bored into at the hole corresponding to the flight required.

NOTE.—These fuzes can also be used for lower times of flight than $7\frac{1}{2}$ seconds if necessary, by boring into them at the $7\frac{1}{2}$ second hole, and then boring down from the top so as to leave in the required length.

Q. Describe Boxer's 30-second metal fuzes, and the mode of fitting them?

A. These fuzes are driven with a composition which burns $\cdot 125$ of an inch in a second; they can be used for all times of flight beyond 10 seconds, and are not to be *cut off*, but bored into at the hole corresponding to the flight required.

Q. Describe Moorsom's percussion fuzes?

A. The percussion fuzes are intended to explode the shell on striking the object, and can be used at all distances. These fuzes have no cap, but are generally covered with a Kitt plaster, to preserve them from damp, which is not to be removed when loading.

N.B.—As the old 3-inch and 4-inch metal fuzes may still be in use, the following is the description and mode of fitting them

The 3-inch fuzes are driven with mealed powder, and are intended to burn $7\frac{1}{2}$ seconds, they can be used at all distances under 1900 yards, and may be either left to explode after lodging in an enemy's ship, or fitted for the distance of the object, as follows :—

When less than $1\frac{1}{2}$ inches of composition are required, *cut* or *bore into* the fuze at 2 inches from the *top of the cup*, and bore

down so as to leave in the required length; when $1\frac{1}{2}$ inches or more composition are required, *cut* or *bore into* the fuze at the corresponding mark.

NOTE.—The 3-inch fuzes are not to be cut off, and great care must be taken to cut into them only so far as just to touch the composition; if these precautions are not taken, the shell will be liable to premature explosion.

The 4-inch fuzes are driven with fuze composition, and are intended to burn 20 seconds, they are used in distant firing, and fitted as follows:

When less than $1\frac{1}{2}$ inches of composition are required, *cut off* the fuze at the $1\frac{1}{2}$ inch mark, and bore up so as to leave in the required length; when $1\frac{1}{2}$ inches or more composition are required, *cut off* the fuze at the corresponding mark.

Q. The distance of the object being known, how is the length of fuze ascertained?

A. Find the time of flight from the range tables; multiply it by .2 if fuze composition, or .4 if mealed powder, which are the parts of an inch of each composition burnt in one second.

Q. Describe Boxer's wooden fuzes for mortars?

A. These fuzes are driven with fuze composition, and are intended to burn 30 seconds.

Q. How are these fuzes fitted for different distances?

A. When less than 2 inches of composition are required, bore into the fuze at the 2 inch mark, then measure the distance from the top of the cup, and bore down so as to leave in the required length; when 2 inches or more composition are required, bore into the fuze at the corresponding mark.

Q. What advantage have the metal over the wooden fuzes, for firing against ships?

A. They do not project so much above the surface of the shell, and are not so liable to be knocked out on striking or passing through a ship's side: the effect of the bursting charge is found to be much greater, and as it is necessary that shells fuzed should be kept on ships' decks, they are much the safest.

Q. What precaution is necessary before cutting or boring into metal fuzes?

A. To take off the cap, as there is a possibility of the composition igniting from friction.

Q. What difference must be made between fitting the time fuzes for firing against ships, and against boats, or uncovered men.

A. The fuzes must be fitted a little longer than the distance requires, when firing against ships, to ensure the penetration of the shell before bursting; but a little shorter when firing against boats or uncovered men, to ensure its bursting in their front.

Q. Describe Boxer's 1-inch fuzes for spherical case, and the mode of fitting them?

A. These fuzes are driven with fuze composition, and are intended to burn 5 seconds: they can be used at all distances under 1600 yards from long guns, and 1200 yards from howitzers; they are not to be *cut*, but *bored into* at the hole corresponding to the length required.

NOTE.—In fitting these fuzes, care should be taken to *bore through* the powder channels at the side and *into* the composition.

Boxer's wooden fuzes for land service are to be fitted in the same manner.

Q. What are Shrapnell shells, or spherical case-shot?

A. Shrapnell shells are filled with balls; they are much thinner than common shells, in order that they may burst with a small quantity of powder, as the balls, after the bursting of the shell, should retain the same direction, which would not be the case were they burst with much powder.

Q. Why are not spherical case-shot used at shorter distances than 200 yards?

A. Because the shell would be liable to burst on firing, as the fuze would require to be bored out to less than $\cdot 1$ of an inch.

Q. What is the general rule for finding the length of fuze, when firing spherical case-shot from long guns?

A. Allow $\cdot 2$ of an inch for the first 500 yards, and an additional $\cdot 1$ for every 150 yards afterwards.

Q. What is the general rule for finding the length of fuze, when firing spherical case-shot from howitzers?

A. Allow $\cdot 2$ of an inch for the first 400 yards, and an additional $\cdot 1$ for every 100 yards afterwards.

Burstg. Chge.	13-inch Shell,	10½lbs.	Wt. loaded, 200lbs.
"	10 "	5½lbs.	" 84lbs.
"	8 "	2½lbs.	" 51lbs.
"	6 "	1lb.	" 24lbs.
"	Boxer's 8-in. Sphl. Case, 10oz.	No. of Balls, 320	" 56lbs.
"	" 6 "	4oz.	" 150
"	" 24-pr. "	3oz.	" 100
"	" 12 "	1oz. 12drs.	" 75
			" 10lbs.

The thickness of the iron of common shell is about $\frac{1}{8}$ of its diameter, and of the spherical case $\frac{1}{10}$ of its diameter.

PREPARATION AND USE OF ROCKETS.

CONGREVE rockets are of four different natures, viz. :—24, 12, 6, and 3-pounders. The cases are of wrought iron, and the rockets are driven upon the same principle as signal rockets. They may be used either as shot, or shell rockets, and the shell may be made to burst either at long or short ranges.

Every rocket is fitted with a fuze, screwed into the base of the shell. The fuze is as long as the size of the shell will admit of, so as to leave sufficient space between the end of it and the inner surface of the shell, for putting in the bursting powder; and the end of the fuze is cupped, to serve as a guide in the insertion of the boring bit. There is a hole in the end or apex of the shell, secured by a screw metal plug, for putting in the bursting powder, and for boring, according to the different ranges at which it may be required to burst the shell.

The following table shows the dimensions of the parts of the rocket which relate to the fuze:—

Nature of Rocket.	From surface of Shell to end of Fuze.	Length of Fuze.	From surface of Shell to top of Cone.	Diamr. of Fuze Compn.	Diamr. of Fuze-hole.	Diamr. of Plug-hole.	Burster.	Thick-ness of Rocket compn. above Cone.
24-pounder	in. 1·6	in. 3·3	in. 9·3	in. ·25	in. ·75	in. ·4	ozs. 8½	in. 3·3
12 „	1·	2·5	7·2	·25	·75	·4	3½	2·8
6 „	·9	2·	5·7	·2	·55	·25	1½	1·8
3 „	·7	1·8	4·	·2	·55	·25	¾	1·5

For Her Majesty's ships, the bursters will be issued, in numbers corresponding to the established number of rockets, in metal lined cases, and the small stores in a box made for the purpose.

For every equipment of 144 rockets the following articles are required :—

Burstors for each rocket ...	...	1	Boring bits, fitted with brass scales	2
Funnels for filling the shells ...	...	2	Turnscrew bits, for the plugs ...	2
Boring stocks or braces ...	...	1	Grease-boxes with grease for the bits	1

OBSERVATIONS ON FIRING ROCKETS.

If the rocket is to be used as a *shot* rocket, the only thing to be attended to, is to take care that there is no powder in the shell, and that the plug is secured in the plug-hole.

If the rocket is to be used as a *shell* rocket, at the *longest* range, the plug is to be taken out and the shell filled, the fuze left at its full length, and the plug replaced.

If at the *shortest* range, the fuze is to be entirely bored through, and the rocket composition bored into, to within $1\frac{1}{2}$ inches of the top of the cone in the 24-pounder rocket, and to within 1 inch in the 12, 6, and 3-pounders.

Nature of Rocket.	Fitting of Rocket.	Elevation.	Approximate Range.	Remarks.
24-pounder	Entire	47°	Yards. 3500	
12 "	"	40	3200	
6 "	"	37	2300	
3 "	"	25	1800	
24-pounder	All Fuze bored out.	27	2000	
12 "	"	20	1600	
6 "	"	15	1000	
3 "	"	10	600	
24-pounder	{ All Fuze and 1 inch Rocket Composition bored out. }	20	1200	
12 "	{ All Fuze and 3 inch Rocket Composition bored out. }	16	1200	
24-pounder	{ All Fuze and Rocket Composition bored out, leaving 1.5 inch at the top of cone }	17	700	It is better not to fire 24-prs. at so low an angle as 17°; nor 12-prs. at so low an angle as 10°
12 "	{ Ditto, leaving 1 inch at the top of cone. }	10	420	
6 "	"	10	420	
3 "	"	8	420	

NOTE.—The above has not been confirmed by any extensive course of practice.

ON THE USE OF THE BORING BITS AND SCALES.

(See Diagrams.)

The composition for the fuzes of the 24 and 12-pr. rockets being of the same diameter, one boring bit serves for both, which is also the case with the 6 and 3-prs.

One brass scale also serves for the 24 and 12-prs., and one for the 6 and 3-prs.; but the graduations for the different natures of fuzes and compositions are separately marked on each scale, in tenths of an inch; and the following method of application is to be attended to.

Take, for instance, the side of the scale marked 24-pr.; the distance from the shoulder A to the point D, is the length from the surface of the shell to the end of the fuze; therefore if the point of the boring bit be placed against the shoulder, and the edge of the stopper screwed fast at that point, and if the shell be bored into up to the stopper, the whole of the fuze composition will be bored out.

If the stopper (the end of the bit being against the shoulder) be screwed on at any point on the scale, in that part marked for the *fuze*, the boring into the fuze with the stopper so fixed, will leave a length equal to the distance from the point D to the mark where the stopper is screwed on.

The distance from the shoulder to the point B is the length from the surface of the shell to *that* depth to which the *greatest* boring into the rocket composition may be made; therefore, if the point of the boring bit be placed against the shoulder and the edge of the stopper screwed fast at that point, and if the rocket be bored into up to the stopper, as much of the composition will be bored out as it is *safe* to do.

In like manner, the stopper being screwed on at any point on the scale, in that part marked for the *composition*, the boring into the rocket with the stopper so fixed will leave a length of composition above the cone over and above that which always *must* be left in.

NOTE.—The boring bit should always be greased.

QUESTIONS AT THE ROCKET BOAT.

Q. How are the stanchion and tube fitted in a rocket boat?

A. The stanchion is fixed to the gunwale, so as to bring the tube as nearly parallel to the keel as possible, in order that the man who steers may take the direction over the stem of the boat.

Q. How is this done?

A. By stretching a line from stem to stern-post, and measuring two equal distances from it to the tube.

Q. What is the necessary precaution before fixing the rocket tube?

A. Examine the tube, and see that no rivets have started, that there are no dents, nor anything that may impede the progress of the rocket.

Q. Why is it desirable to fire with the whole length of tube?

A. It gives the rocket a truer direction and a greater range.

Q. When is the short tube to be used?

A. In a heavy seaway, with high elevations, but this practice is very uncertain.

Q. Where should the men on the foremost thwart go when firing?

A. Aft the stanchion, to be clear of the fire thrown back from the rocket.

Q. Who are the men to alter the elevation?

A. Those nearest the work.

Q. What is the use of the laniard on the stanchion, which extends to the opposite side of the boat?

A. To steady the stanchion.

Q. Who are the men to fix the staff to the rocket?

A. The men on the after thwart.

Q. What is the necessary precaution before screwing them together?

A. Take off the cap, and see that there is no dirt in the screw, nor anything that may cause explosion.

Q. How is the rocket placed in the tube?

A. At the lower end; the seam of the rocket being opposite to the seam of the tube, it is forced up past the spring, and pulled gently back till it rests on it.

Q. If a shell rocket hangs in the tube, what is to be done?

A. Let go the elevating line and the rear fastening, so that the tube may fall in the water. If a shot rocket, there is no danger.

NOTE.—The elevating line should be made fast with a running hitch, for this purpose, and the rear part of the tube should be attached to the gunwale in such a way that the tube may be quickly disconnected from the boat.

Q. If any of the rocket staves are bent, what should be done with them.

A. Keep them to the last.

Q. Where are the rockets stowed in the boat?

A. In the stern sheets, in their cases, with the heads aft.

Q. By what force is a rocket propelled through the air?

A. By the force of its own composition: the rocket being accurately poised by the staff, has the greatest velocity at about one-half the range.

Q. How is a rocket directed with the wind across the range, against the range, and with the range?

A. In the first place, by pointing to leeward of the object; in the second, by giving more elevation; and in the third, less elevation than the distance requires, as the wind acts on the staff more than on the rocket.

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Q. If a shell rocket hangs in the tube, what is to be done?

A. Let go the elevating line and the rear fastening, so that the tube may fall in the water. If a shot rocket, there is no danger.

NOTE.—The elevating line should be made fast with a running hitch, for this purpose, and the rear part of the tube should be attached to the gunwale in such a way that the tube may be quickly disconnected from the boat.

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MORTAR EXERCISE.**13-INCH SEA-SERVICE MORTAR.**

PROVIDING STORES.

- No. 1.—Provides tube box, and plummet.
,, 2.—Sponge, sheepskin, and handspike.
,, 3.—Shell hooks, and handspike.
,, 4.—Traversing tackles, and priming wire.
,, 5.—Trigger-line, and fuze implements.
,, 6.—Cartridge case.

EXERCISE WITH 8 MEN

(in a Mortar Boat).

- No. 1.—Commands, points, and primes.
,, 2.—Sponges, wipes the bottom of the shell, uncaps the fuze, assists to put in shell, and traverses.
,, 3.—Puts in cartridge, assists to put in shell, and traverses.
,, 4.—Clears and serves the vent, pricks the cartridge, and traverses.
,, 5.—Prepares fuzes, takes them to 8, traverses, and fires.
,, 6.—Brings cartridge, and occasionally relieves 7.
,, 7.—Prepares cartridges in the magazine.
,, 8.—Prepares and hooks on shell in the hatchway.

NOTE.—3 men from the mortar vessel are required to assist in the Shell room and one man to assist in the Magazine. The remainder of the crew should be stationed to whip up shell.

When the mast of the vessel is left standing, the shell can be served from the shell hatch to the muzzle of the mortar without using the crane.

Tackles should be used for traversing in a sea way, or when the mortar works heavily, 2 and 4 work the *right* traversing tackle, 3 and 5 the *left*: spare Nos. from the crew of the mortar vessel assisting if necessary.

The powder is made up in bags containing 10 lbs., $4\frac{1}{2}$ lbs., 2 lbs., 1 lb., and $\frac{1}{2}$ lb., so that with a supply of empty bags, any charge can be quickly got ready, without weighing the powder in scales.

Weight of mortar, 100 cwt. Extreme charge, 20 lbs.

Weight of shell, 200 lbs. Bursting charge, $10\frac{1}{2}$ lbs.

(For Ranges, see Table, page 108).

N.B.—Land service mortars are worked in a similar manner, the only difference being that handspikes are required for running up and training, and a shell beam or shell hooks for bringing up the shell. They are trained for the object by bringing them on with pickets placed in the parapet for the purpose.

All mortars with the ordinary coin, are elevated at an angle of 45° ; this elevation may be altered if necessary by putting in an additional coin, or, by substituting a smaller one for that commonly used.

Weight of 13-inch land service mortar, 36 cwt.	Extreme charge, 9lbs.
" 10 " " 18 "	" 4 "
" 8 " " 8 $\frac{1}{2}$ "	" 2 "

DISPARTING INSTRUCTION.

Q. Explain the use of a diagonal scale and calliper compasses.

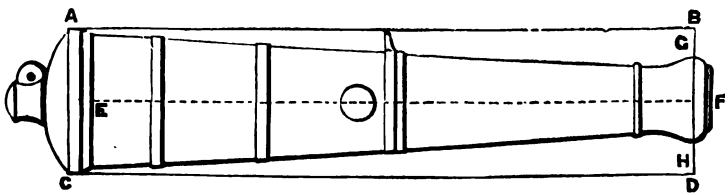
4. The diagonal scale is used to measure inches, tenths, and hundredths of an inch; calliper compasses are used for measuring the diameter of the parts of any piece of ordnance, and also to measure the calibre of a gun.

Q. How is a gun disparted by callipers?

4. By taking the diameter of the base-ring, and of any other part of the gun where it is intended to place the dispart; half the difference of these diameters will be the height of the dispart. Any additional height above where the greater diameter is taken must be added, and any above where the less diameter is taken, subtracted.

NOTE.—The diameters may also be found by measuring the circumferences of the base-ring, and of that part of the gun where it is intended to place the dispart, with a piece of silk, thread, or fine twine, and dividing them into 3 equal parts; the dispart is then found as before, but this is only an approximation. The correct method of obtaining the diameter from the circumference is to divide the latter by 3·1416, which is the circumference of a circle when the diameter is 1.

To illustrate the Rule for Disparting.



From the points A and C draw the lines A B and C D parallel to E F, the axis of the gun: then it is evident that B D will be equal to A C; and that when G H, the diameter of the muzzle, is taken from B D or A C, the diameter of the base-ring, the difference will be the two equal parts B G and H D; and half this difference must be B G, the dispart for the muzzle.

Q. How is a gun disparted by battens?

A. Get two thick battens, having iron bands on them, to prevent their warping; their breadth should be somewhat less than the diameter of the bore, and their length about twice that of the gun to be disparted; one of these should be pushed to the extremity of the bore, and the other placed on the base-sight, and made parallel to the one in the bore, by their distances apart at the muzzle and outer ends being made equal; the distance from the top of the gun to the bottom of the upper batten will be the height of the dispart.

Q. How are the degrees on the tangent-sight calculated?

A. Measure from the hinder part of the base-sight to the highest part of the dispart as radius. Multiply this distance by 12 to bring it into inches, and by $\cdot 21$, and divide by 12, which will give the length of the tangent of 1° in inches, and tenths of inches, to be marked downwards on the tangent-sight as far as its length permits.

NOTE.— $\cdot 21$ of an inch is the tangent of 1° when the radius is 1 foot.

N.B.—The above method will answer as far as about 5° with most guns, after which the muzzle appears above the dispart, when the tangent sight must be graduated for the whole length of the gun by one of the following methods, and the notch in the muzzle used in pointing, instead of the dispart.

1st. Transfer the length of the short tangent-sight on to the sight about to be marked, and measure downwards from that point, the length of the tangent of 1° for the whole length of the gun; or,

2nd. Find a dispart for the muzzle, and the length of the tangent of 1° degree for the whole length of the gun; multiply this length by the number of degrees required, and subtract the muzzle-dispart, the remainder will be the length to be measured down from the top of the sight; or

3rd. When it is required to mark the sight beyond 10° , find a dispart for the muzzle: then in the triangle A B C



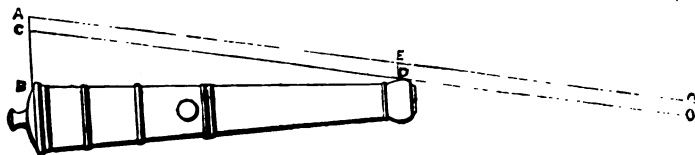
let A C = the length of gun, and angle C = the number of degrees required; then A B, the length of the tangent, = A C. Tan. C; from A B subtract the muzzle dispart, and the remainder will be the length to be measured down from the top of the sight.

NOTE.—The long tangent-sights ought to be made of wood, as brass ones are liable to bend forward when the gun is fired.

For the 32-pounder 56 cwt. gun 4 tangent-sights are required to take the elevation up to 10° , the first being marked to 4° , the others to 6° , 8° , and 10° , respectively.

For the 8-inch guns 3 tangent-sights are required, the first being marked to 5° , the others to $7\frac{1}{2}^\circ$ and 10° respectively.

To Illustrate the 2nd and 3rd Methods of Marking the Tangent-sights.



Suppose in the figure that the gun has a muzzle dispart E D, and is laid for the object O with the tangent-sight raised to 10° as A B, then A E O is the line of sight; but as muzzle disparts are never fitted to guns, it follows that a length equal to the dispart must be cut off from the tangent sight to keep the gun at the same elevation; we then have the line of sight C D O' parallel to the former line of sight A E O, and C B the reduced length of sight for 10° .

Q. How is the line-of-metal elevation found?

A. Find a dispart for the muzzle, and the length of the tangent of 1° for the whole length of the gun; then, as the length of the tangent of 1° for this radius is to 1° , so is the dispart on the muzzle to the line-of-metal elevation.

Q. Explain the method of finding the dispart angle.

A. Find a dispart for the muzzle, and the length of the tangent of 1° from the dispart to the muzzle; then, as the length of the tangent of 1° for this radius is to 1° , so is the dispart on the muzzle, to the angle of elevation required.

NOTE.—This angle varies with different guns from 4° to 6° .

Q. Describe the method of fitting beds and coins?

A. Place the gun in the housing position, and the distance from the rear axletree to the base-ring of the gun, will be the thickness of the bed and stool; then run the gun close out, and lay it horizontal, with the coin on its flat, and square with the bed: the distance from the coin to the base-ring will be the thickness of the pivot depression chock, to be placed on the rear axletree.

Q. How is a gun laid horizontal without a spirit level?

A. Run the gun close out, and stretch a line taut across from the centre of two opposite *upper* port sills; then place a straight batten on top of the base-sight and dispart, and make the distance between each end of the batten and the line equal; the gun will then be horizontal when the ship is upright. Or, if there are impediments amidships, place a batten on top of the base-sight and dispart; and raise, or lower the breech till the batten is parallel to another, similarly placed on an adjoining gun which is known to be horizontal.

Q. How are the side scale and standard marked?

A. The gun must be run close out, and laid horizontal, the side-scale is then placed perpendicular on the step of the carriage in a line with the base-ring, and a mark made on it opposite the notch on the side of the base-ring, for P.B. Find the length of the tangent of 1° with the distance from the centre of the trunnions to the base-ring as radius, and mark downwards (from P.B.) for elevation, and upwards for depression. For the standard, make a mark on the button of the gun, and place the standard perpendicular to the deck; the pointer in the standard is then placed opposite the mark on the button, and a mark made on the standard close down to the box for P.B.; the degrees are marked as for the side-scale, but the radius is taken from the centre of the trunnions to the rear part of the button.

NOTE.—The height of the centre of the trunnions from the deck should be marked on the back of the standard.

Q. Describe the method of marking beds and coins ?

A. The bedstool and depression chock, having been first properly fitted, get a perfectly straight-edged batten, and mark it as for a standard, but without numbering the degrees; then place the batten perpendicular against the button of the gun, and make a mark on the button opposite a degree on the batten, also a mark on the bed and coin, immediately under the base-ring for P.B.

For *Elevation*, keep continually withdrawing and marking the coins, as far as they can be used with safety, the small coin commencing where the large one leaves off.

For *Depression*, the large coin is marked in a similar manner, being pushed in from P.B., first on its flat, then on its edge.

NOTE.—One coin for each description of gun being marked as above, the others can be marked by them, provided they are of the same size.

The coins may also be very correctly marked by spirit level.

The large coins for 32-pounder guns usually give, on their flat, 3° elevation, and $1\frac{1}{4}^{\circ}$ depression; for 8-inch guns, 3° elevation, and 2° depression.

The small coins give 3° more elevation, and the large coins on their edge give 3° more depression.

Q. Explain the method of using the spirit level?

A. The spirit level is placed in the bore of the gun or on the top of a straight-edged iron batten, resting on the top of the base-sight, and top of the dispart, and the limb of the instrument moved until the bubble rests in the centre of the tube; the elevation, depression, or horizontal position of the gun, as the case may be, is denoted by the index. It must be remembered that this instrument is of no use where there is any motion.

Q. How is the extreme elevation and depression that a port will admit of ascertained ?

A. First, run the gun in, so that the muzzle will work in the whole arc of the port, and lay it horizontal, in the manner before explained, or P.B. by marked coin; then measure the distance between the lower part of the muzzle and the lower port sill, which will be the tangent of depression for a radius taken from the centre of the trunnions to the muzzle. Find the length of the tangent of 1° for that radius, then, as the length of the tangent of 1° is to 1° , so is the tangent of depression to the number of degrees of depression. For elevation,

measure the distance between the upper part of the muzzle and the upper port sill, or subtract the diameter of the muzzle and the tangent of depression from the whole height of the port, and the remainder will be the tangent of elevation for the same radius; and proceed as for depression.

NOTE.—Ship's ports usually allow of from 10° to 11° of elevation, and from 6° to 7° of depression.

Q. What is the rule for making sweep-pieces.

A. Extreme train the gun to the right and left, and measure the distance from the horns of the carriage to the ship's side in both positions; make marks on the ship's side where the distances were taken about $1\frac{1}{2}$ inches below the port-sill, and with a radius of 5 feet 6 inches describe an arc; measure the distance between the marks on the ship's side, and strike it as a chord to the arc; from the extremities of the chord set off perpendiculars equal to the distances taken from the horns of the carriage to the ship's side, and join these by a right line, which will give the dimensions of the sweep-piece. To give 3 and 4 more room for loading, the square of the sweep-piece may be reduced, taking care to add the same thickness to the carriage as additional horns.

Q. How is a line parallel to the keel found?

A. Find the centre of any two midship stanchions, and the line joining them may be transferred to any part of the deck.

Q. How is the angle of training of a gun found?

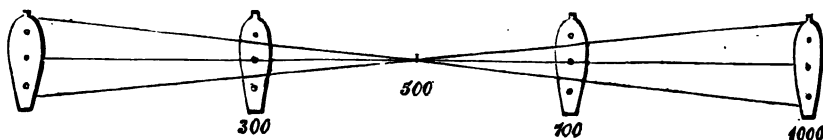
A. Having a line parallel to the keel, transfer the axis of the gun to the deck, by placing a line on the top of the gun and letting fall a plummet, in rear of the gun and beyond the parallel line; strike a line through these two points, and the protractor being placed on the point of intersection, will denote the number of degrees of training that the gun has. It may also be found by erecting a perpendicular on the parallel line upon any length of base (suppose 2 feet) cutting the line representing the axis, and by describing an arc with 12 inches radius, which, multiplied by 3.1416, and divided by 180, will give the length of 1° ; multiply this by 5 (for convenience) for the length of 5° .

NOTE.—The angle can also be found by means of a looking glass with graduated frame.

Ships' ports usually allow of from 40° to 44° of training each way.

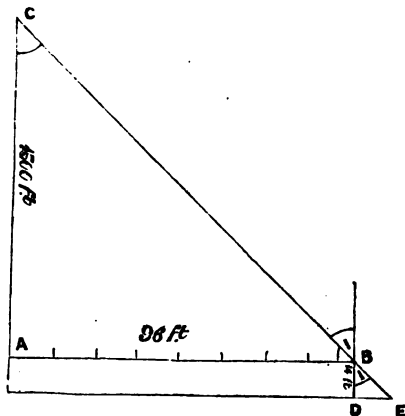
Q. Explain the method of concentrating a ship's broadside.

A. The guns are trained in the direction of the object by bringing them on with lines, hooked to the centre of each port, and held immediately under marks made on the beams or deck over head, for the several bearings of a-beam, $1\frac{1}{2}$ and 3 points before and abaft the beam, and laid by marked coin according to the heel of the ship and the distance of the object—the direction being given by aid of an instrument from upper deck. The midship gun is used as the directing gun, and the angles of training should be ascertained for the above bearings at a constant distance of 500 yards; for though the calculations are made for this distance, yet this method of laying the guns is intended for all ranges within 1000 yards, at which distance, if the guns are properly laid, both as regards elevation and direction, the shot will be at the same distance from each other as on leaving the guns.



To Calculate the Angles for Concentrating on the Beam.

Let A be the midship gun trained right a-beam, B the foremost one, C the object at a constant distance of 500 yards. Let the distance from A to B, supposed known, equal 96 ft., and the distance from the centre of port in-board be taken as 14 ft., being the same for all the guns. Then the angle C can be easily found, for

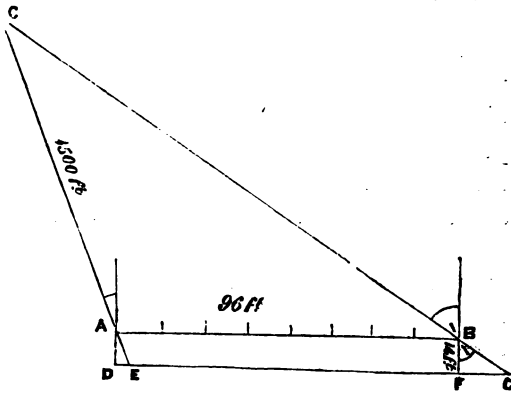


$\frac{AB}{AC} = \tan. C$, the angle of training for the foremost gun. Again, in triangle B D E, we have $DE = BD \cdot \tan. C$, the length of the tangent to be set off over head, from the point opposite the centre of the port. For the intermediate guns, divide the length

D E by the number of guns *before* the midship one, which will give the length of the tangent for the gun next to the midship one; twice this will be the length for the next gun, and so on:—Thus, if D E=10·7 inches, and the number of guns before A be 8, we have $\frac{10 \cdot 7}{8} = 1 \cdot 3$ inches, or the length for the gun next to A; 2·6 inches=the length for the next gun, and so on. The same measurements answering for the guns abaft A.

To Calculate the Angles for Concentrating 3 points abaft the Beam.

Let A be the midship gun trained 3 points abaft the beam, B the foremost one, C the object distant 500 yards. Let the distance from A to B, supposed known, equal 96 feet, and the distance from the centre of the port in-board equal 14 feet as before. Then from the expression,



$$\frac{AC + AB}{AC - AB} = \frac{\tan. \frac{1}{2} (B + C)}{\tan. \frac{1}{2} (B - C)}$$

the angle B can be easily found, which, taken from 90°, will give the angle of training for the foremost gun. Again, in triangles A D E, B F G, we have D E=A D. Tan. A and F G=F B. Tan. B. which are the required lengths of the tangents to be set off over head from the points opposite the centres of these ports. For the intermediate guns, divide the difference between the two lengths D E and F G by the number of guns *before* the midship one, and *add* this common difference to the length D E for the gun next before the midship one, and so on to each gun in succession. Thus, let F G=10ft. 5in., and D E=9ft. 4in., the difference=1ft. 1in.; let the number of guns before A be 8, then we have $\frac{1}{8} = 1 \cdot 6$ inches, the common difference for each gun; therefore 9 ft. 5·6 in.=the

length for the gun before A; 9 ft. 7·2 in.=the length for the next gun, and so on.

The measurements for the corresponding guns abaft the midship one, will be found by *subtracting* the common difference, from D E and so on, from each gun in succession.

The calculation of the angles for 3 points before the beam, or for $1\frac{1}{2}$ points before and abaft the beam, is performed in the same manner.

To Mark the Beams over head after the Angles are calculated.

Having a line parallel to the keel, over head, at any convenient distance in rear of the guns, measure the assumed distance 14 ft. from the centre of port inboard, and place a perfectly straight-edged batten there, parallel to the keel line; then transfer the centre of the port to the batten by stretching a line taut across from the centre of two opposite *upper* port-sills; or with any length of line as radius, from the centre of the port, describe an arc cutting the batten before and abaft the centre; half the distance between these marks will give the point corresponding to the centre of the port. From this centre, measure off on the batten, to the right and left, the lengths of the tangents for the different bearings, as calculated above; and then transfer these points to the beams or deck immediately over the batten, taking care to paint them in such a manner, that the marks for one gun may not be mistaken for those of an adjacent gun; the batten is then removed.

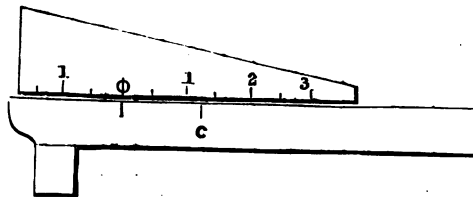
NOTE.—The hook to which the line is attached should be driven in at the centre, and flush, within two or three inches of the outer part of upper port-sill, and the 14 ft. measurement used in the calculation of the angles, must be taken from the hook; the line having an eye spliced in the outer end, to go over the hook, and a toggle in the other, to be held by No. 1 at the time of laying the gun.

INSTRUCTIONS FOR THE USE
OF
MOORSOM'S DIRECTOR (*New Pattern*)
FOR FIRING A CONCENTRATED BROADSIDE.

1st. The instrument should be placed at the gangway nearly over the midship gun, or in the most convenient position, on battens parallel to the keel, and horizontal when the ship is upright. The arc is marked in degrees and points; and at the several bearings of concentration, raised knobs are placed underneath as a guide by night. The large inner sight is graduated in degrees from the centre as a tangent-sight, with the distance between the outer and inner sight as a radius, so that it may be set to any degree of elevation or depression according to the heel of the ship, or, if *rolling*, to that particular degree of the *roll* at which it may be desirable to deliver the broadside.

2nd. The *small* depression sight is marked in degrees in the same manner; so that it may be set to the angle of depression due to the height of the Director above the guns on the *lowest* deck, for the different distances, as shown in the Table; and these angles should be painted on the board, so as to be always at hand when required.

3rd. The beds should also be marked for the angle of depression at 500 yards, due to the height of the guns on each deck above those on the *lowest* deck as in Fig.: and this mark C, should be considered as the P. B. mark in laying the guns for all distances within 500 yards; the broadside will thus be concentrated at this distance on the *lowest gun deck* of the enemy: but for all distances beyond 500 yards, the proper P. B. mark should be used.



4th. The instrument, having been adjusted to the required bearing, the *small* depression sight is set to the angle of depression due to the distance, and then the sliding bar raised, or lowered, till the sights are on with the *lowest* gun deck of the enemy, when the *heel* will be denoted by the *upper edge* of the sliding bar; the same orders are then given as already explained in 3rd Instruction, and the signal or order to fire should be given when the guns are laid and the object is brought on with the sights.

NOTE.—The director may be used with advantage whenever target practice is going on from a ship at sea, as it will show at once whether the guns will bear upon the object at any particular time or not, and also for ascertaining the distance of an object, as explained in "Questions on Naval Gunnery," page 85.

ANGLES OF DEPRESSION FOR DIFFERENT HEIGHTS AND DISTANCES.

Height.	200 yds.	300 yds.	400 yds.	500 yds.	600 yds.	800 yds.	1000 yds.	Height.
Feet.	Angle of Depression	Angle of Depression	Angle of Depression.	Angle of Depression.	Angle of Depression.	Angle of Depression.	Angle of Depression.	Feet.
6	0 34	0 23	0 17	0 14	0 12	0 9	0 7	6
12	1 9	0 46	0 34	0 28	0 23	0 17	0 14	12
18	1 43	1 9	0 52	0 41	0 34	0 26	0 21	18
24	2 18	1 32	1 9	0 55	0 46	0 34	0 28	24
30	2 52	1 55	1 26	1 9	0 57	0 43	0 34	30
36	3 26	2 18	1 43	1 23	1 9	0 52	0 41	36
42	4 0	2 40	2 0	1 36	1 20	1 0	0 48	42

QUESTIONS ON NAVAL GUNNERY.

Q. 1. What nature of guns are used in the naval service?

A. 68-pounders and 32-pounders, which throw solid shot, and 10-inch and 8-inch guns, which throw hollow shot, also 24-pounder and 12-pounder brass howitzers for boats.

Q. 2. What is meant by the chamber of a gun, and what is its chief advantage?

A. By the term chamber is meant a contraction of the bottom of the bore, to give a greater thickness of metal at the breech for withstanding the explosion of the charge, as in Hollow shot guns.

Q. 3. What is meant by windage?

A. The difference between the diameters of the bore and shot, which is allowed on account of irregularities in the casting of shot, the effects of rust, and for their expansion when heated.

Q. 4. What is the windage allowed for long guns?

A. The windage of the old pattern guns is $\cdot 233$ of an inch, and it varies in the newly constructed guns from $\cdot 2$ to $\cdot 125$ of an inch.

Q. 5. Are there any disadvantages in too great windage?

A. The deflection, as well as the variation in the ranges of shot is partly attributable to the windage.

Q. 6. What other cause affects the accuracy of shot?

A. All shot are cast more or less eccentric, and it has been proved, that if they are fired with the centre of gravity upwards, the range will be increased, if downwards, decreased; and the deflection will allways be to that side on which the centre of gravity happens to be placed.

Q. 7. What means should be adopted to prevent shot from rusting?

A. Either grease or paint them, and keep them as dry as possible; it is imperative to attend to this, in consequence of the reduction of windage.

Q. 8. Suppose a shot jammed in a gun, how is it to be removed?

A. Destroy the charge by pouring water down the vent and muzzle, and then introduce a small quantity of powder and blow it out.

Q. 9. What are the ingredients used in making gunpowder?

A. Nitre 75 parts, charcoal 15, and sulphur 10.

Q. 10. How is the quality of powder ascertained by inspection?

A. By rubbing it in the hands, to find whether it contains any irregular hard lumps, and by inflaming a small quantity on a copper-plate, or piece of white paper; if good, it instantly takes fire, leaving no black spots or foulness on the copper, nor any particles that will burn the paper.

Q. 11. How is large-grained powder proved by comparison?

A. It is compared with proof powder in throwing a 68-lb. shot from a mortar with a charge of 2 ozs.; the powder to be proved should give as great a range as the proof powder. The best cylinder powder gives a range of 250 feet, pit powder 220, and powder which has been re-dried from 107 to 117 feet. Any other weight of shot, with a small charge, thrown from a gun will answer the same purpose. Should powder be deteriorated, and there should be no means of exchanging it, compare the range given by it at 1° or 2° of elevation with that shown in the range tables; and increase the charge or the elevation, in the proportion in which the range of the damaged powder falls short of that given by the good.

Q. 12. How is powder mealed?

A. By being rubbed on a table until fine enough to pass through a lawn sieve. Not more than 1 lb. should be mealed at a time; and care should be taken that no iron be used in the construction of the table or rubber.

Q. 13. What is meant by scaling a gun?

A. Firing from it a small quantity of powder, to blow out any dirt or rust adhering to its sides.

Q. 14. Describe grape-shot.

A. Nine 3-lb shot for 32-pounder guns, 15 for 8-inch, and 24 for 10-inch guns; for 32-pounder and 8-in. guns they are confined in canvas, round an iron spindle having a circular iron plate at the bottom, and secured by a line passing round it in each division formed by the shot: for 10-inch guns, they are inclosed in cylindrical tin cases, having an iron bottom, with a wooden cover at the other end fastened by a few tacks; the end having the iron plate is to be entered first.

Q. 15. Will grape penetrate the side of a ship?

A. No; the principal advantage to be derived from its use is in cutting away the enemy's rigging; a small portion entering the ports may also take effect; but it is not recommended, unless close along-side.

Q. 16. Describe case-shot.

A. A cylindrical case of tin containing shot of 8 ozs. weight for 32-pounder and 8-inch guns, and of 14 ozs. weight for 10-inch guns.

Q. 17. State the advantages and disadvantages of double-shotting guns.

A. At the distance of 400 yards, two shot fired together, from heavy 32-pounder and 68-pounder guns, with reduced charges, will generally have sufficient accuracy to hit, and velocity to pass through the side of a ship. The disadvantage of double-shotting is the increased violence of recoil.

Q. 18. Of what diameter are the vents of English guns?

A. $\frac{3}{4}$ or .22 of an inch. When enlarged by firing to .28 inch (by which time the lower part of the vent will generally be about 1 inch in diameter) the gun ought to be returned for re-venting, which cannot be done if the vent is enlarged beyond that size.

Q. 19. How may a piece of ordnance be rendered unfit for service?

A. There are several methods, but the most common is spiking; that is, driving a nail or spike as far as possible into the vent, and breaking it off. Guns may be rendered unserviceable by breaking off the trunnions with a heavy hammer, or with brass ordnance, a shot fired against the chase will indent it so that it cannot be loaded. A gun may be easily burst by loading with a heavy charge, and wedging a shot with spike-nails about half-way down the bore.

Q. 20. Explain the different nature of spikes used in the British service, and the mode of unspiking guns.

A. There are two sorts. 1st. The common steel spike of a conical form, 4 inches in length. 2nd. The spring spike, which is only used temporarily to disable guns which are likely to be retaken from the enemy. If a gun is spiked with the common spike, load with a reduced charge and double shot; put an ounce or two of gunpowder in a copper ladle, and scatter it along the whole length of the bore, then fix a piece of quick-match, or Bickford's fuze, in the muzzle of the piece, by which

means the gun may be easily fired. If with a spring spike, the rammer should be pressed gently to the bottom of the bore, and the spike turned round until the rammer-head bears on the spring, when by forcing upon it, and, at the same time, drawing the spike up, the spring may be relieved, and the vent cleared.

Q. 21. What is the best means of spiking a gun if unprovided with any common spikes?

A. The ramrod of a musket broken off in the vent and clinched by ramming a shot home upon it; or nails, without heads.

Q. 22. What is meant by the term Initial Velocity?

A. The greatest velocity a shot has, or that with which it leaves the gun. With a charge of $\frac{1}{3}$ rd the weight of the shot, this has been found to be about 1600 feet in a second.

Q. 23. Does the wad or force with which it is rammed home affect the initial velocity, or what is the use of the wad?

A. It has been found that the velocity is the same, whether a wad is used or not; and that the degree of force with which it is rammed home has no effect. Its use is to prevent the shot from shifting in the bore by the motion of the vessel or otherwise.

Q. 24. What forces act upon a shot when it leaves the gun?

A. Three—viz., the charge which propels it; the force of gravity which causes it to fall; and the resistance of the air which acts directly in opposition to the shot.

Q. 25. Will a large shot range farther than a small one, or a solid shot than a hollow one, the initial velocity being the same?

A. Yes; for in both cases the greater weight gives them greater power to overcome the resistance of the air.

Q. 26. Which will have the greatest penetration, a large shot or a small one, both leaving the gun at the same rate?

A. The large one will penetrate farthest, for the penetrations of shot are in proportion to their diameters; with the same shot the penetrations are in proportion to the charges.

Q. 27. What is the difference in the effect of shot, upon wood and iron?

A. The holes made in wood partially close up again, and may be easily plugged; but those made in iron are larger than the shot and irregular, and are therefore more difficult to plug, the splinters also are more numerous, and the shot itself splits and acts more destructively than a shell.

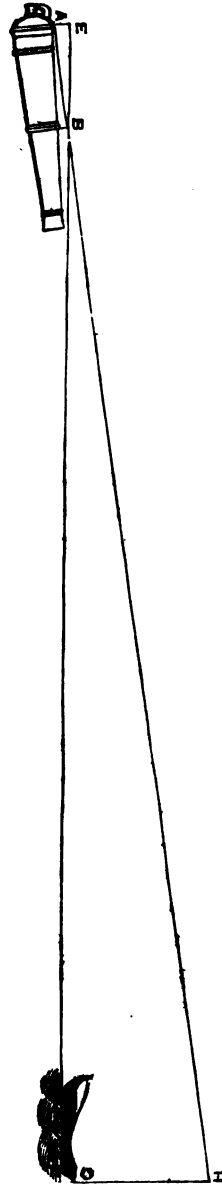
Q. 28. Why are the chances of inaccuracy in practice at *long ranges*, much greater than at short ones?

4. Because the greater the elevation, the more curved will be the path of the shot at the end of its range; the effect of any error in pointing increases with the distance; the tendency to deviation, caused by windage and the position of the centre of gravity of the shot, will have more time to act, as will also the force of the wind and partial currents of air. The above should always be borne in mind when firing at long ranges.

Q. 29. Explain the method of pointing a gun at an object beyond P.B. distance ; and illustrate it by a diagram.

A. This may be done by either of the two following methods:—Pointing by the line of dispart at a certain height corresponding to the distance off; as in pointing at a particular part of a ship's mast in order to strike the hull, which is called **Tangent firing**, or by pointing directly at the object by sights fitted to the gun. The former method will evidently fail when firing at a small object where there is nothing above it by which the height can be estimated. To show how, by the use of tangent-sights the same thing may be accomplished, let O be the object fired at, H O the height at which the gun must be pointed above the object to allow for the fall of the shot: then $HBO = EBA$, the angle of elevation; and since HOB and EAB are right angles, the triangles ABE and BHO are similar, therefore $OB : OH :: AB : AE$. That is, the height to be pointed above is to the distance, as the height of the tangent-scale is to its radius.

Q. 30. In firing by tangent-sight, would the same elevation be required to strike a ship's top as to strike the hull?



A. Yes: for the elevation by tangent-sight depends *only* on the distance, and as the distances from a ship's top or from her hull would be *very nearly* equal, there would be no sensible difference in the drop of the shot.

Q. 31. What advantage is gained by taking off the trucks?

A. An increase of elevation in the port.

Q. 32. How may a gun be fired with elevation or depression greater than the port will admit of?

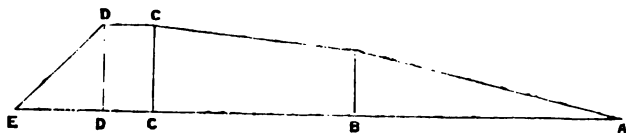
A. For elevation, by placing inclined planes in rear of the rear trucks; for depression, by placing them in rear of the fore trucks, or by using tripping coins or toggles.

Q. 33. How can the object be kept sight of with extreme elevation?

A. By the use of a quarter tangent-sight with a dispart on the trunnions, or by placing two pickets on the side of the carriage.

Q. 34. Describe the method of fitting inclined planes.

A. They should be made of the same form as in diagram; the length must be rather less than the distance between the fore and rear trucks, and the height should not exceed $5\frac{1}{2}$ inches.



Q. 35. Explain one of the readiest methods of finding the distance of an object on shore without instruments.

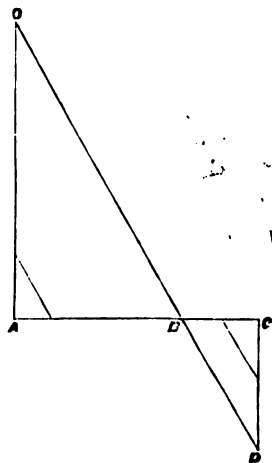
A. Make a right-angled triangle with a piece of cord, the sides being in the proportion of 3, 4, and 5: the distance is then found by means of the proportional sides of similar triangles, as in Fig.

Let $AB = 100$ yds.

$BC = 20$ "

$CD = 100$ "

Then $BC : AB :: CD : AO$ the dist. required.



Q. 36. Mention the readiest method by which the distance of objects at sea may be ascertained.

A. When the height of the object is known (as for instance an enemy's ship of a known class), measure the angle subtended by her masthead down to a point in the same plane with the observer's eye. It should be *specially* remembered, that no accurate practice can be made when the distance is not known. (See Table, Pages 103 and 104.)

Q. 37. When the height of the object is not known, how may the distance be ascertained?

A. Having a line marked on the *Knight-heads* at right angles to the keel, station a person at the Concentrating Director (which should be fixed as far aft as possible) to keep the object on with the sights; and another forward, to make a signal when the *line* is brought on with the object by the helm; the length between the two observers and the angle by the director being known, the distance can be ascertained. (See Table, Pages 103 and 104.)

Q. 38. How is a pendulum made to vibrate seconds and half seconds?

A. For seconds, suspend a musket ball to a piece of thread measuring $39\frac{1}{4}$ inches from the centre of the bullet to the knot: for half seconds, the length must be 9.8 inches. The pendulum can be used for taking the time of flight, or ascertaining distance by sound, which travels 1100 feet in a second.

Q. 39. Should any other means of pointing than by sights be resorted to as long as the object can be seen?

A. No; they should be considered as the sole guide of the guns, as long as the enemy can be seen, and the distance is known.

Q. 40. When firing bow or stern guns with much heel at an object beyond P.B. distance, what allowance must be made for the deflection of the shot?

A. The sights being out of the perpendicular, the gun must be pointed more or less to windward of the object, according to the distance, and the heel of the ship. Thus, if the ship is heeling over 5° , and the object is 1000 yards distant, the gun should be pointed for the weather-quarter boat, if a large ship, in order to strike amidships.

NOTE.—The proper elevation due to the distance must be given; as although the tangent-sight is slightly lowered by the heel of the ship, yet it is of no practical importance.

Q. 41. How should night sights be fitted?

A. The tangent-sight and dispart should be made of wood, with broad square heads painted a *dead white*, the dispart having a broad deep notch cut in it to guide the sight.

Q. 42. When may ricochet firing be practised?

A. In very smooth water, when the distance is uncertain and from about 1000 to 2500 yards. It is more accurate than direct firing, at these distances, but the penetration is doubtful, and the least ripple affects the range. It may be very useful against boats, and low objects. Distant charges should be used, and the guns pointed at the object, with $\frac{1}{4}^{\circ}$ elevation.

Q. 43. Explain the system of ricochet firing for enfilading batteries.

A. The distance should not exceed 600 yards. The guns should be fired with low charges, and with elevations of from 5° to 10° .

Q. 44. Is the stress on the gun increased by the elevation?

A. Yes; the higher the elevation, so much greater is the stress on the gun with similar charges of powder, and the same weight of projectiles.

Q. 45. What is the precaution with respect to sponges and sponging?

A. To have the sponges *actually tried* in the guns as soon as they are received on board, and clipped so that they may go *easily* home to the bottom of the bore. In sponging, to see that the vent is well stopped, and the sponge thrust *hard home* to the bottom of the bore, and well pressed against it, whilst two round turns are given; no fire can then remain.

Q. 46. What is the difference of strength in breechings?

A. Their strength is proportional to the squares of their circumferences. Thus, a 9-inch rope is to an 8-inch as 81 to 64, and these numbers divided by 6, will give the number of tons weight that each of the ropes will bear if new, and of good manufacture.

Q. 47. Is any precaution necessary in using cartridges which have been withdrawn from a gun?

A. They should not be used in re-loading guns which have been recently fired.

Q. 48. What should be the guide in selecting the charge for shell firing?

A. That charge should be used which will ensure penetration through one side of a ship.

Q. 49. At what distances should the different charges be used?

A. For heavy guns, distant charges beyond 900 yards, full between 500 and 900, and reduced at shorter distances. With lighter guns the reduced charge must not be used at a greater distance than 400 yards; but, as a general rule, it is the best plan not to use reduced charges, except in close action. In cases where great precision and penetration are required, the *heaviest* charges should be used, irrespective of the distance.

Q. 50. At what distance may the fire be opened at sea in moderate weather, with guns whose charges are not less than 6 lbs.?

A. As the practice is uncertain beyond 1500 yards, the fire should not generally be opened until at that distance. Between 1500 and 1000 yards, half the shot should strike the side of a line-of-battle ship, and under 1000 yards nearly all should take effect. With lighter guns, the fire should not be opened so soon.

Q. 51. In distant firing from guns above 40 cwt., what proportion of shot have been found to take effect?

A. In perfectly smooth water, and with the ship steady, at 1500 yards, about 75 per cent. are found to strike the side of a line-of-battle ship; at 2000 yards, about 45 per cent.; at 2500 yards, about 25 per cent.; and at 3000 yards, not more than 10 per cent.

Q. 52. How many rounds of shot should be usually kept on deck, and how many should be handed up for exercise?

A. 15 rounds for each gun (on both sides) should at all times be kept on the main and lower decks, and 10 on the upper deck, and at all general exercises 10 more should be handed up. The necessity for handing up shot in action should be avoided as much as possible.

Q. 53. Where should the shells for immediate supply be kept?

A. Between the beams amidships; in the wake of carlings, or between the bitts, and in the square of the hatchways. Not less than 4 broadsides should be on deck on going into action, and every facility should be made for handing up an increased supply.

Q. 54. What would be the consequence of entering a shell, fuze inwards?

A. The fuze would be driven in by the explosion, and the shell burst in the gun.

Q. 55. May shot and shell combined be used with all guns that will bear double-shotting?

A. Yes; the shot must always be entered first, and the shell pressed close home upon it, as otherwise the shell would burst in the gun. A *grummet* wad may be placed over the shell if there is much motion.

Q. 56. If a shell bursts directly after leaving the gun, are the pieces ever found to come backwards?

A. No; they are always driven forward, the force of the charge being greater than the explosive power.

Q. 57. What are some of the causes of failure of shells fitted with time fuzes?

A. The fuzes do not always ignite, nor do they all burn exactly alike; the distance of the object may alter while the fuze is being prepared, or the fuze may be extinguished by striking the water, or by being plugged up with wood on entering the ship's side; lastly, in the hurry of loading, the cap may be forgotten, in which case the shell will be of no more use than a shot.

Q. 58. What advantages have Moorsom's fuzes over Time fuzes?

A. They are not liable to the causes of failure which affect time fuzes, and are therefore invaluable against ships; but they should not be used against boats or troops, nor are they so efficient as time fuzes in bombarding towns or fortresses.

NOTE.—In the event of any Shells fitted with Moorsom's fuzes, being recovered after firing, they should be very carefully handled, as they are very liable to explode on falling against a hard substance.

Q. 59. Is there any difference in the elevation required for firing shot or shell from the same gun, at the same object?

A. Yes; rather less elevation is required for shell under 1100 yards, and rather more beyond that distance.

Q. 60. What precaution is necessary in fixing a direct-action lock?

A. To see that the hammer strikes exactly over the vent, and recedes clear of it.

Q. 61. What is the most frequent cause of missing fire with percussion tubes?

A. From not pulling the trigger-line with sufficient strength; for if fired with a suitable pull, they will hardly ever miss fire.

Q. 62. Are percussion tubes liable to become injured by damp?

A. Yes, they easily imbibe moisture. The tube boxes should be kept as dry as possible; if there is time, before the commencement of an action, the tubes in the boxes should be returned, and fresh ones substituted.

Q. 63. What are the ingredients used in making percussion powder?

A. Equal parts in weight, of antimony and chlorate of potass. These ingredients should be kept separate till required for use, and great care must be taken to keep them dry, as they easily imbibe moisture.

Q. 64. If these materials can be procured, what is the best way of making a substitute for percussion tubes and caps, supposing they are expended or have been injured by damp?

A. A very small quantity, twisted up in a piece of paper, and flattened down upon the vent, will make a good substitute for tubes. Percussion caps may be used over again several times if they are re-primed, by putting a small quantity of percussion powder at the bottom, and confining it there with a piece of paper. If no old caps can be procured, a cap made in a former with three or four layers of cartridge paper, and some percussion powder placed at the bottom, as above, will make a good substitute.

Q. 65. What is the best way of destroying a boom thrown across a river or narrow entrance?

A. By exploding under it a breaker filled with from 50 lbs. to 100 lbs. of powder by means of Bickford's fuze, or a portfire protected by a funnel; the breaker, if possible, should be made fast *under* the boom, but if not, care must be taken that it shall touch it, and that no part float above water, or the effect will be lost. The breaker may be fixed in this way in from one to two minutes. Any explosion on the top of the boom is useless.

Q. 66. What is the best way of breaching a stockade?

A. If there is a banquette or parapet of earth within, a charge of not less than 50 lbs. of powder should be placed at the foot of it, covered with about ten times its weight of earth, in bags, and fired by a slow match, or Bickford's fuze. The powder, without this proportion of earth, will have *very little effect*. If there is no banquette, a smaller quantity of powder and earth will make a breach.

Q. 67. Can a stockade be breached by shells?

A. Yes. A stockade with a banquette may be breached by 1 or 2, 8-inch, 3 or 4, 32-pounders, or by 5 or 6, 24-pounder shells exploding in the banquette.

Q. 68. How long does Bickford's fuze burn, and how should a breaker be fitted with it to explode under water?

A. It burns from 2 to 3 feet in a minute. When the end is inserted into the bung, it must be served with oakum, and paid with pitch, then hauled taut up through the bung, and a plaster of canvas paid with pitch placed round the opening. Two lengths of fuze should be used in the event of one going out.

MISCELLANEOUS SUBJECTS.

REMARKS ON PREPARING FOR ACTION.

1. On beating to quarters, all mess gear and mess traps, including those of officers, together with glass sashes, and tables and stools, should be passed below, and a certain number of tables should be placed on chests in the cockpit, as the *Surgeon may desire*, with beds on them for the wounded, care being taken that all passages for passing up Powder, Shot, Shell, and other stores, are kept perfectly clear.

Arrangements should be made at the hatchways on each deck for passing down the wounded, to prevent as far as possible the men leaving their quarters for this purpose.

2. All shot boxes, fire buckets, &c., should be moved away from the ship's side and placed amidships, and all wooden ladders not required should be removed, leaving rope ones in their places; 10 *rounds of Shot* per gun, in addition to the supply usually kept on the different decks, should be got up and placed in large grummets, in rear of the guns.

Not less than 4 *broadsides of Shell* should be placed in the most secure positions amidships, and every facility made for handing up an increased supply.

3. The guns' crews should put on their belts, the cutlasses being kept overhead ready for use, and the marines' muskets should be brought to the guns and placed overhead on hooks put there for the purpose; the men should be made to wear shoes, and such clothing as is least liable to catch fire.

The lashings of the beds to the bed bolts should be resecured, and *lanyards* rove through the beds, should be *toggled to the coins* and made fast to the cleat at the side of the bed, to prevent them from flying out.

All breeching seizings should be well secured; all swabs well wetted, and one placed at each gun, and fire buckets filled with water.

Tubs of fresh water should be placed in convenient positions on each deck, and the decks should be wetted and sanded if necessary.

4. A concentrating line, spare trigger-lines, vent plugs, and a large supply of wads should be at every gun; breechings should be rove in the bow and stern ports; long tangent-sights, spare tubes, trucks, side-tackles, train-tackles and locks, with wrenches for unscrewing, should be placed overhead in convenient positions, in rear of *each division* of guns.

5. Fire screens should be let down, and gratings shipped; fire engines and pumps should be rigged, and hoses screwed on ready for use.

A number of shot-plugs should be placed in the wings, and tongs and shovels for picking up Red Hot Shot.

All the Magazine and Shell-room stations should be filled up, and the gunner should see the tank in handing-room filled with fresh water, and the flooring of the handing-rooms covered with water.

6. Rigger men should place the rigging-stoppers, dead-eyes, and luffs ready for use, get up top screens and hammocks in the tops, and place axes and tomahawks on different parts of the upper deck, for cutting away rigging and clearing wrecks.

N.B.—Relieving tackles should be hooked, spare tiller shipped and ropes rove. Splinter nettings should be in their places on the upper deck, and against the ship's side between decks; yards and gaffs should be slung, braces toggled, stays and backstays snaked, and preventer stays got on the masts.

Boom boats should be clear for hoisting out, quarter boats topped up; sails and all articles likely to take fire should be well wetted. Grappling irons, with warps to each, should be kept in the main and mizen chains, those in the latter being fitted to trice up to the after davits, in order to hook up any of the gear likely to foul the screw, the warp being rove through a block at the spanker boom end.

In Steam Vessels, top gallant masts and rigging should be sent on deck, and all unnecessary gear unrove.

GUIDE FOR OFFICERS ON DRILLING QUARTERS.

In the following Exercises the Guns are supposed to be already loaded, and run out square in the ports.

OFFICER OF QUARTERS.	REMARKS.
<p>“Prime.” “Point.” “— Yards,—Charge, Point at—.” “4 rounds independent firing at the same object.” “Commence Firing.”</p>	<p>INDEPENDENT FIRING.</p> <p>Here name the distance, charge, and object.</p> <p>The exercise may be varied, by ordering the Captains of the guns to raise or lower the tangent-sight for 100 yards every round, and to shift breechings after the 1st or 2nd round.</p>
<p>“Prime.” “Point.” “Right abeam.” “Elevate.” “Lay the guns horizontal.” “4 rounds quick firing, commencing at the word “Fire.” “Ready.” “The whole, Fire.”</p> <p>“Prime.” “Point.” “In the direction of — .” “Elevate.” “Lay the guns horizontal.” “4 rounds quick firing in the direction of that object.” “Ready.” “The whole, Fire.”</p>	<p>QUICK FIRING (<i>Abeam</i>).</p> <p>No. 2 chalks the bed and coin at this order.</p> <p>—</p> <p>(<i>When the object is before or abaft the beam.</i>)</p> <p>Here name the object.</p> <p>No. 2 chalks the bed and coin at this order.</p>

OFFICER OF QUARTERS.	REMARKS.
<p>“Clear away the port tackle falls.” “Run in.” “Lower the Ports.” “Lower deck Exercise.” “Ship is on—tack, heeling —°, By Coin, lay the guns horizontal.” “Haul taut.” “Trice up.” “With Staff Sponge, Sponge.” “Load.” “Trice up.” “With Rope Sponge, Sponge.” “Load.” “Trice up.”</p>	<p>LOWER DECK EXERCISE.</p> <p>The order “Haul Taut” is given by the Officer for the 1st round only, No. 1 giving the order on all other occasions. The order “Trice up” should be given just before the pendulum shows the ship has reached the degree of the <i>roll</i> or <i>heel</i> for which the guns are laid.</p> <p>Repeat the exercise for two or three rounds.</p> <p>When the men are perfect in this drill, instead of continuing it in slow time, lay the guns as before, then give the order,</p> <p>“3 rounds Quick Firing, Lower Deck Exercise.” “Trice up.”</p> <p>After the 1st round, the guns are to be sponged, loaded, and hauled taut, without orders, the Nos. 1 waiting for the word “Trice up” each time.</p>
<p>“Cease Firing.”</p> <p>“Man the port tackle falls.” “Trice up.” “Square in the Ports, Run out.”</p>	<p>The guns are “run in” at this order.</p> <p>Nos. 9 and 10 pick up hand-spikes, and pass them to 3 and 4: when the port is up 3 and 4 shift back side-tackles, and right rear-man attends train-tackle.</p>
<p>“Prime.” “Point.” “— Yards, — Charge, Point at —.” “The whole, Fire.” “Stop the vent.” “Run in.” “Sponge, Load, and shift breechings.”</p>	<p>SHIFTING BREECHINGS.</p> <p>Here name the distance, charge, and object.</p> <p>When the breechings are shifted, the guns are to be run out and fired at the same object, without orders, and when in, sponged, Nos. 1 giving the order, “Man the Port or Star-board Gun,” to enable the officer to inspect the breechings.</p>

OFFICER OF QUARTERS.	REMARKS.
<p> "Prime." "Point." "Extreme Train Muzzle left." "— Yards, — Charge, Point at — on the bow." "3 Rounds Independent firing on the Bow, Beam, and Quarter." "The 2nd Round at — yards." "3rd Round at — yards." "Commence Firing." </p>	<p> FIRING ON THE BOW, BEAM, AND QUARTER. <i>(Starboard Guns manned.)</i> Here name the distance, charge, and object, also the object on the beam and quarter. The Exercise may be varied by firing the 1st round in succession, on the supposition that the foremost gun would bear first. The Foremost and After quarters should occasionally be exercised to work on opposite sides, as if to engage an enemy coming down on the bow, and up on the opposite quarter. </p>
<p> "Prime." "Point." "Extreme Train Muzzle right." "Ships passing on opposite tacks distant 400 yards, double shottd." "Ready." "Foremost gun, Commence Firing." </p>	<p> PASSING ON OPPOSITE TACKS. <i>(Port Guns manned.)</i> The tangent-sights are to be raised to the correct elevation and the guns pointed at the horizon: they will thus be correctly laid when the object is brought on with the points of the sights; 2 then chalks the bed and coin. The 1st round is fired in succession, the 2nd gun firing when 1st gun gives the word "well" in running in, and so on with the others. The guns are to be double-shottd, and the 2nd round is to be fired, extreme trained aft, the coins being replaced to the chalk mark, after the guns are round, to save time in elevating. Both ships are supposed to be moving at the rate of 5 knots per hour, therefore the 2nd round must be fired in less than 1m. 30s. </p>

OFFICER OF QUARTERS.	REMARKS.
<p>“Prime.” “Point.” “— Yards, — Charge, Point at —.” “Broadside Firing at the same object.” “The whole, Fire.” “The whole, Fire.” “Cease Firing.”</p>	<p>BROADSIDE FIRING.</p> <p>Here name the distance, charge, and object.</p> <p>The guns are to be sponged, loaded, and relaid for the same object without orders.</p> <p>Continue the exercise for two or three rounds.</p> <p>The exercise may be varied by ordering the Captains of guns to raise or lower the tangent-sight for 100 yards after each broadside, and to shift breechings after the 1st or 2nd. If there is <i>rolling</i> motion the guns should be laid by marked Coin, according to the distance of the object and <i>degree of the roll</i> at which it is intended to deliver the broadside: the Tangent-sights being raised for the distance, to enable No. 1 to keep sight of the object; the beds and coins should be chalked, and the word “Fire” given when the pendulum shows the heel for which the guns are laid; or the Officer observes the position of the midship gun’s coin, and directs the other guns to place their coins to the same mark, and then looking along the sights of the midship gun he gives the word “Fire” when the object is on.</p> <p>This firing may also be conducted by divisions.</p>
<p>“Prime.” “Point.” “—° Elevn. (or Deprn.) by Coin, — Pts. before (or abaft) the beam.” “Lay the Guns.” “Broadside Firing.” “Ready.” “Fire.”</p> <p>“Ready.” “Fire.” “Cease firing.”</p>	<p>CONCENTRATED FIRING.</p> <p>Here name the elevation or depression allowing for the charge, distance, and heel of the ship.</p> <p>These orders are to be given from upper deck in practice. The guns are to be sponged, loaded, and laid on the same or any other bearing named, without further orders.</p> <p>Repeat the exercise for 3 or 4 rounds, or it may be carried on independently.</p>

OFFICER OF QUARTERS.	REMARKS.
<p>“Man both sides.”</p> <p>“Secure from raking ahead,” (or “astern.”)</p> <p>“At the word, ‘Up to your Quarters;’ man the Starboard (or Port) Guns, raise the sights for 200 yards Double Shot, and fire one round on the Bow (or Quarter.)”</p> <p>“Up to your Quarters.”</p>	<p>TO SECURE FROM A RAKING FIRE.</p> <p>Nos. 2 unhook the inner blocks of train-tackles and carry them abaft (or before) the guns; 5 and 6 throw the falls over the brackets, and hold on to them, all the Nos. closing up between and under cover of the guns. The Nos. before the foremost gun, and abaft the after one, come round abaft or before the gun to get under cover. Officers and powder boys find cover behind the bitts, masts, capstan, &c.</p>
<p>“Man the Guns for Transporting.”</p> <p>“Two ports further forward, Transport the Guns.”</p> <p>“Replace the Guns.” (as before).</p> <p>They should then pay particular attention to the movements of their guns, giving their orders sharply and in time to prevent running foul of anything. Each gun when at its proper port, loads and fires <i>one</i> round, the distance and object being previously named.</p> <p>The right rearman should be cautioned to attend to nothing but the train-tackle, and the guns should be wormed or fired before being thrown fore and aft.</p> <p>Arming the Bow and Stern from the Midship Guns, should be performed in the same manner.</p> <p>Transporting alternate guns is only intended as a harbour exercise.</p>	<p>TRANSPORTING.</p> <p>Port watch man the left, and starboard watch the right guns.</p> <p>The Captains of guns should not give the word “Run in” till train-tackles are shifted to the quarter train bolts, abaft the guns, the guns will thus be half trained when in.</p>

OFFICER OF QUARTERS.	REMARKS.
<p>“Dismounting Crews, Dismount the Guns.”</p> <p>“Mount the Guns.”</p> <p>“Change Crews.”</p> <p>“Dismount the Guns.”</p> <p>“Mount the Guns.”</p>	<p style="text-align: center;">DISMOUNTING.</p> <p>The guns' crews should be told off for manning the proper dismounting guns at this order; also for changing crews.</p> <p>The exercise may be varied by shifting carriages.</p>

NOTE.—The Quarters should be frequently exercised in loading with Shell, Shot and Shell, and Double Shot, also in working with Rear trucks off, as if firing Weather or Lee guns or rolling heavily, and in pointing with high elevations.

N.B.—Whenever the object is lost sight of, as, for instance, when working round a Target at sea, the guns should be trained as far as possible in the right direction, and *pointed at the horizon*, the Tangent-sights being raised for the *distance of the object*; but if the horizon or object cannot be seen by reason of smoke for some time, the guns should be laid by marked Coin, according to the *distance of the object* and *heel* of the ship, the Tangent-sights being *kept up* as before; Nos. 1 will then merely have to get the *direction* on, the moment the object is visible, as the guns will be correctly laid for *elevation* in both cases.

NOTE.—The above Exercises are made out simply as an Outline on Drilling Quarters, and not with a view to confine Officers *only* to these Exercises.

INSTRUCTIONS FOR THE USE OF RED HOT SHOT.

1st. Red Hot Shot are not, for the present, to be fired from any guns but 68 and 32-pounders; the Charges used must not exceed $\frac{3}{4}$ of the heaviest charge allowed for the gun, as the expansion of the shot by being heated considerably decreases the windage, and consequently much increases the stress on the gun: thus the 56 cwt. 32-pounder gun, whose heaviest charge is 10 lbs., should not be fired with a higher charge than 8 lbs.: the charges for other guns must be likewise proportionably decreased.

2nd. To prevent accidents, every ship will be allowed a Red Hot Shot Gauge, through which the shot are to be passed before they are brought away from the furnaces: a Red Hot Shot Bearer will also be supplied, in which the shot are to be triced up and then conveyed to the guns; but if these are not issued, the shot can be triced up in the Ash buckets.

3rd. Shot can be readily made red hot in the furnaces of Steam Vessels, and to a moderate extent this can also be done in the copper holes of Sailing Ships; a 32-pounder shot will become red hot in the furnace of a Steamer in about 15 minutes, and care must be taken that they are not heated *beyond a bright red*, as otherwise they are liable to fuze and to become misshapen, and if so used they would be very liable to jam in the gun.

4th. It is very dangerous to fire a shot when jammed in a gun, but a Red Hot Shot may be rapidly cooled by water, which will cause it to contract, and the shot will then probably be easily removed from the gun; but if not, a small quantity of powder introduced down the vent, after the charge has been destroyed, will effect its removal with certainty.

5th. Shot expand about $\frac{1}{15}$ part of their diameter when heated to a bright red; therefore, as the mean diameter of 32-pounder shot, when so heated, is 6.273 inches, it is considered unsafe to fire Red Hot Shot from either the 32 cwt. or

the 25 cwt. 32-pounder guns, or from the 32-pounder carronade, as the windage of those guns is very small.

6th. Clean shot, and shot that pass readily through the Cold Shot gauges, should be used for firing when red hot; the shot must be scraped and cleaned to remove the scales and dirt, and then passed through the Hot Shot gauges, before they are sent up from below.

7th. Whilst shot are being heated they should be turned, as the part resting on the furnace bars heats much more rapidly than the upper part; when the shot are heated to a *bright* red they must be removed from the furnaces whether they are wanted or not.

8th. Great care must be taken that the cartridges used are not in any way broken or damaged. A number of dry and wet junk wads must be in readiness at the guns, also a number of wet grummet wads; these wads should be soaked in water for two or three hours beforehand, and then the water well pressed out of them, and care must be taken that they are made small enough to fit easily in the guns when swelled by being soaked, otherwise the loading will be very difficult; the sponge should also be well damped, and water kept at the guns in case of accidents.

9th. It has been found by experiment, that Red Hot Shot do not burn more than the outer yarns of a well-soaked junk wad, even though left in the gun for a considerable period; and it has been also proved, that there is but little danger of the Cartridge becoming ignited, even though quantities of smoke should come up through the vent; the grummet wad over the shot is necessary to prevent it from shifting in the bore from the motion of the vessel, or otherwise, and it should be well soaked to prevent it catching fire.

Precautions for loading guns with Red Hot Shot.

First, the Cartridge, then a dry junk wad, and then a wet junk wad are to be entered by No. 3, and 4 is to force them home together; it is recommended that this should be done with a damp sponge to ensure any grains of powder being

destroyed that may remain in the gun; No. 1 pricks the cartridge, and 4 withdraws and returns the sponge.

The shot is then to be brought up to the left of the gun, and entered by 3 and 4; the gun should be laid with sufficient elevation to allow the shot to roll home of itself; 3 then places a wet grummet wad over the shot, and 4 receives the rammer, forces it home, and assisted by 3, gives it two smart blows to ensure the shot being close home.

After the loading is completed, the gun is to be run out, trained and elevated for the object in precisely the same manner as when firing cold shot; but the sooner the gun is fired the better, as the shot not only cools very rapidly when in the gun, but it is believed that it has a tendency to become misshapen from cooling unequally. It is further recommended, when firing Red Hot Shot, to select those guns that may be the nearest to the Engine Room hatchway, and not to fire them indiscriminately from all guns.

A TABLE showing the angles subtended by the Mainmasts of French ships of war, between the Water line and the Truck, with the corresponding distances.

(Taken from Sir H. Douglas's Naval Gunnery.)

The observer is supposed to be 20 feet above the level of the water.

Yards.	Line of Battle Ships.			Frigates.		Corvettes	Brigs.	Yards.
	120 Guns.	90 Guns.	82 Guns.	60 Guns.	44 Guns.	24 Guns.	18 Guns.	
	Truck to the Water Line, 220 ft.	Truck to the Water Line, 202 ft.	Truck to the Water Line, 192 ft.	Truck to the Water Line, 188 ft.	Truck to the Water Line, 168 ft.	Truck to the Water Line, 120 ft.	Truck to the Water Line, 112 ft.	
200	20 20	18 47	17 54	17 33	15 46	11 22	10 37	200
300	13 48	12 42	12 6	11 51	10 37	7 37	7 7	300
400	10 25	9 35	9 7	8 55	7 59	5 43	5 20	400
500	8 21	7 41	7 18	7 9	6 24	4 34	4 16	500
600	6 59	6 25	6 6	5 58	5 20	3 49	3 34	600
700	5 59	5 30	5 14	5 7	4 35	3 16	3 3	700
800	5 14	4 49	4 35	4 29	4 0	2 52	2 40	800
900	4 40	4 17	4 4	3 59	3 34	2 33	2 22	900
1000	4 10	3 51	3 40	3 35	3 12	2 17	2 8	1000
1100	3 49	3 30	3 20	3 16	2 55	2 5	1 57	1100
1200	3 30	3 13	3 3	2 59	2 40	1 54	1 47	1200
1300	3 14	2 58	2 49	2 46	2 28	1 46	1 39	1300
1400	3 0	2 45	2 37	2 34	2 17	1 38	1 31	1400
1500	2 48	2 34	2 26	2 23	2 8	1 32	1 25	1500
1600	2 37	2 24	2 17	2 14	2 0	1 26	1 20	1600
1700	2 28	2 16	2 9	2 7	1 53	1 21	1 15	1700
1800	2 20	2 8	2 2	2 0	1 47	1 16	1 11	1800
1900	2 13	2 2	1 56	1 53	1 41	1 12	1 7	1900
2000	2 6	1 56	1 50	1 48	1 36	1 9	1 4	2000
2200	1 55	1 45	1 40	1 38	1 27	1 2	0 58	2200
2400	1 45	1 36	1 31	1 30	1 20	0 57	0 53	2400
2600	1 37	1 29	1 24	1 23	1 14	0 53	0 49	2600
2800	1 30	1 23	1 19	1 17	1 9	0 49	0 46	2800
3000	1 24	1 17	1 13	1 12	1 4	0 46	0 43	3000
3200	1 19	1 12	1 8	1 7	1 0	0 43	0 40	3200
3400	1 14	1 8	1 5	1 3	0 57	0 40	0 38	3400
3600	1 10	1 4	1 1	1 0	0 53	0 38	0 35	3600
3800	1 6	1 1	0 58	0 57	0 51	0 36	0 34	3800
4000	1 3	0 58	0 55	0 54	0 48	0 34	0 32	4000

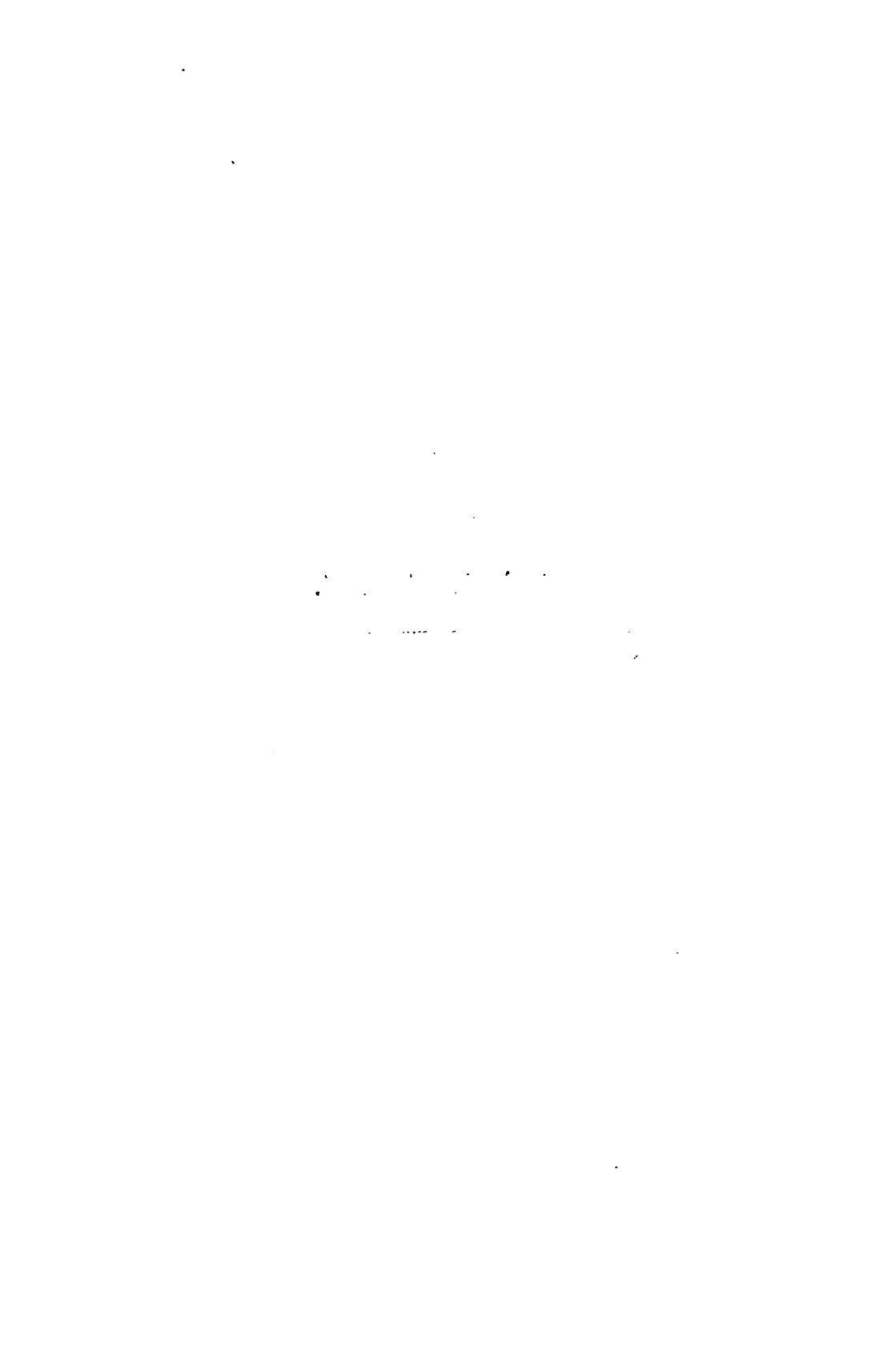
A TABLE showing the angles subtended by the Mainmasts of French ships of war, between the Water line and the Topmast crosstrees, with the corresponding distances.

(Taken from Sir H. Douglas's Naval Gunnery).

The observer is supposed to be 20 feet above the level of the water.

Yards.	Line of Battle Ships.			Frigates.		Corvettes	Brigs.	Yards.
	120 Guns.	90 Guns.	82 Guns.	60 Guns.	44 Guns.	24 Guns.	18 Guns.	
	Topmast Crosstrees to the Water Line, 158 ft.	Topmast Crosstrees to the Water Line, 151 ft.	Topmast Crosstrees to the Water Line, 138 ft.	Topmast Crosstrees to the Water Line, 139 ft.	Topmast Crosstrees to the Water Line, 121 ft.	Topmast Crosstrees to the Water Line, 85 ft.	Topmast Crosstrees to the Water Line, 77 ft.	
200	14 52	14 13	13 2	13 7	11 28	8 5	7 20	200
300	9 59	9 33	8 45	8 48	7 41	5 24	4 54	300
400	7 31	7 11	6 34	6 37	5 46	4 3	3 40	400
500	6 1	5 45	5 16	5 18	4 37	3 14	2 56	500
600	5 1	4 48	4 23	4 25	3 51	2 42	2 27	600
700	4 18	4 7	3 46	3 47	3 18	2 19	2 6	700
800	3 46	3 36	3 18	3 19	2 53	2 2	1 50	800
900	3 21	3 12	2 56	2 57	2 34	1 48	1 38	900
1000	3 1	2 53	2 38	2 39	2 19	1 37	1 28	1000
1100	2 45	2 37	2 24	2 25	2 6	1 29	1 20	1100
1200	2 31	2 24	2 12	2 13	1 55	1 21	1 13	1200
1300	2 19	2 13	2 2	2 2	1 47	1 15	1 8	1300
1400	2 9	2 3	1 53	1 54	1 39	1 9	1 3	1400
1500	2 0	1 55	1 45	1 46	1 32	1 5	0 59	1500
1600	1 53	1 48	1 39	1 39	1 26	1 1	0 55	1600
1700	1 46	1 42	1 33	1 34	1 21	0 57	0 52	1700
1800	1 40	1 36	1 28	1 28	1 17	0 54	0 49	1800
1900	1 35	1 31	1 23	1 24	1 13	0 51	0 46	1900
2000	1 30	1 26	1 19	1 20	1 9	0 49	0 44	2000
2200	1 22	1 19	1 12	1 12	1 3	0 44	0 40	2200
2400	1 15	1 12	1 6	1 6	0 58	0 40	0 37	2400
2600	1 9	1 6	1 1	1 1	0 53	0 37	0 34	2600
2800	1 5	1 2	0 56	0 57	0 50	0 35	0 31	2800
3000	1 0	0 57	0 52	0 53	0 46	0 32	0 29	3000
3200	0 56	0 54	6 49	0 49	0 43	0 30	0 27	3200
3400	0 53	0 51	0 46	0 47	0 40	0 29	0 26	3400
3600	0 50	0 48	0 44	0 44	0 38	0 27	0 24	3600
3800	0 47	0 45	0 41	0 42	0 36	0 25	0 23	3800
4000	0 45	0 43	0 39	0 40	0 35	0 24	0 22	4000

R A N G E S.



A PRACTICAL TABLE OF APPROXIMATE RANGES, with the TIMES of FLIGHT.

Nature of Gun.	Charge of Powder.	RANGE IN YARDS.																
		200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1800	2000
10-inch Gun, 86 Cwt.	lbs. { 12 {	$\frac{1}{2}$ "	$\frac{1}{2}$ "	$\frac{3}{4}$ "	1"	1"	1"	1"	1"	2"	2"	2"	2"	2"	2"	2"	2"	2"
	1" {	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"
For all 8-inch Guns, with these Charges.	10 {	$\frac{1}{2}$ "	$\frac{1}{2}$ "	$\frac{3}{4}$ "	1"	1"	1"	1"	1"	2"	2"	2"	2"	2"	2"	2"	2"	2"
	8 {	$\frac{1}{2}$ "	$\frac{1}{2}$ "	$\frac{3}{4}$ "	1"	1"	1"	1"	1"	2"	2"	2"	2"	2"	2"	2"	2"	2"
For 32-pounder 56 Cwt. Guns, with these Charges, see Note.	5 {	$\frac{1}{2}$ "	$\frac{1}{2}$ "	$\frac{3}{4}$ "	1"	1"	1"	1"	1"	2"	2"	2"	2"	2"	2"	2"	2"	2"
	10 {	1"	1"	1"	1"	1"	1"	1"	1"	2"	2"	2"	2"	2"	2"	2"	2"	2"
32-pounder Gun, 25 Cwt.	8 {	$\frac{1}{2}$ "	$\frac{1}{2}$ "	$\frac{3}{4}$ "	1"	1"	1"	1"	1"	2"	2"	2"	2"	2"	2"	2"	2"	2"
	6 {	$\frac{1}{2}$ "	$\frac{1}{2}$ "	$\frac{3}{4}$ "	1"	1"	1"	1"	1"	2"	2"	2"	2"	2"	2"	2"	2"	2"
	2 1/2 {	$\frac{1}{2}$ "	$\frac{1}{2}$ "	$\frac{3}{4}$ "	1"	1"	1"	1"	1"	2"	2"	2"	2"	2"	2"	2"	2"	2"
	2 1/2 {	$\frac{1}{2}$ "	$\frac{1}{2}$ "	$\frac{3}{4}$ "	1"	1"	1"	1"	1"	2"	2"	2"	2"	2"	2"	2"	2"	2"

Note.—The Ranges for the 32-pound 56 cwt. gun will answer for 32-pound guns having the same windage, though of different lengths. And the Ranges, with the 10, 8, and 6 lb. charges for the 32-pound 56 cwt. gun may be taken as an approximation for the Ranges with 8, 6, and 4 lb. charges respectively for 32-pound guns having less windage.

RANGES with SEA-SERVICE IRON MORTARS at 45°, obtained by Marine Artillery in 1803, at Landguard Fort.

13-INCH SEA-SERVICE MORTAR, 100 cwt. Shell loaded, 200 lbs. Bursting charge, 10½ lbs.

Charge	1 lb.	2 lbs.	3 lbs.	4 lbs.	5 lbs.	6 lbs.	7 lbs.	8 lbs.	9 lbs.	10 lbs.	12 lbs.	14 lbs.	16 lbs.	18 lbs.	20 lbs.
Range	Yds. 420	Yds. 620	Yds. 980	Yds. 1240	Yds. 1650	Yds. 1940	Yds. 2180	Yds. 2480	Yds. 2800	Yds. 2960	Yds. 3330	Yds. 3620	Yds. 3850	Yds. 4100	Yds. 4200
Time of Flight	" 9	" 11·25	" 14·12	" 16·36	" 18·06	" 20·56	" 21·9	" 23·4	" 24·25	" 25·3	" 26·9	" 28·1	" 29·1	" 29·8	" 30·4

10-INCH SEA-SERVICE MORTAR, 52 cwt. Shell loaded, 92 lbs. Bursting charge, 5½ lbs.

Charge	1 lb.	2 lbs.	3 lbs.	4 lbs.	5 lbs.	6 lbs.
Range	Yds. 1030	Yds. 1690	Yds. 2180	Yds. 2560	Yds. 2890	Yds. 3090
Time of Flight	" 15	" 19	" 21·8	" 24	" 25·5	" 26·55

A TABLE of CHARGES and TIMES of FLIGHT for dropping a Shell over the Parapet of a Battery, or for dislodging an Enemy from behind an Embankment.

Nature of Gun.	Elevation by Tangent-Sight.	RANGES IN YARDS, WITH CHARGES AND TIME OF FLIGHT.				
		400	500	600	700	800
10-inch, 86 cwt.	15°	15 ounces 4½"	19 ounces 5½"	22 ounces 5¾"	25 ounces 6½"	28 ounces 6¾"
10-inch, 86 cwt.	10°	20 ounces 4"	24 ounces 4½"	28 ounces 5"	32 ounces 5½"	36 ounces 6"
8-inch, 65 cwt.	10°	14 ounces 4"	18 ounces 4½"	22 ounces 5"	25 ounces 5½"	28 ounces 6"
32-pounder, 56 cwt.	10°	7 ounces 4'	8½ ounces 4½"	10 ounces 5"	12 ounces 5½"	14 ounces 6"

NOTE.—When firing shells on the water for practice with the above charges and elevations, the fuzes must be fitted half a second shorter than the time of flight given in this table, otherwise they will strike the water and be extinguished, as shells with that flight are intended to burst *immediately* after striking the ground.

**RANGES with SEA-SERVICE IRON ORDNANCE obtained on board Her Majesty's Ship "Excellent."
Elevation by Tangent-Sight.**

Nature of Gun.	Length.	Weight.	Diameter of Bore.	Windage.	Weight of Shot or Shell.	Charge.	The Elevation and Range in Yards, with corresponding Times of Flight.																		
							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
10-Inch	9 4	84	10	16	{ Shot } 84 { Shell } 11	12	500 1 1/2	800 3 3/4	950 4 3/4	1100 5 1/2	1400 6 3/4	1600 7 1/2	1780 8 1/4	1940 9 1/4	2100 9 3/4	2260 10 1/4	2420 10 3/4	2580 11 1/4	2660 11 3/4	2800 12 1/4	2930 13 1/4	3060 14 1/4	3180 15 1/4		
8-Inch	9 0 8 10	65 60	8-05	125	Shot 56	10	350 1 1/2	550 2 1/2	750 3 1/2	950 4 1/2	1150 5 1/2	1300 6 1/4	1500 6 3/4	1700 7 1/4	1950 8 1/4	2160 8 3/4	2340 9 1/4	2530 9 3/4	2700 10 1/4	2850 10 3/4	3000 11 1/4	3120 11 3/4	3240 12 1/4	3340	
"	"	"	"	"	Shell 51	10	350 1 1/2	450 2 1/4	600 3 1/4	800 4 1/4	1000 5 1/4	1240 6 1/4	1500 7 1/4	1760 8 1/4	1980 8 3/4	2160 9 1/4	2340 9 3/4	2500 10 1/4	2660 10 3/4	2780 11 1/4	2900 11 3/4	3000 12 1/4	3100 12 3/4	3200 13 1/4	3300 14 1/4
8-Inch	9 0 8 10 8 0	65 60 54	8-05	125	Shot 56	8	350 1 1/2	450 2 1/4	600 3 1/4	800 4 1/4	980 5 1/4	1180 6 1/4	1430 7 1/4	1660 8 1/4	1880 8 3/4	2060 9 1/4	2240 9 3/4	2420 10 1/4	2600 10 3/4	2760 11 1/4	2900				
"	"	"	"	"	Shell 51	8	350 1 1/2	450 2 1/4	650 3 1/4	730 4 1/4	880 5 1/4	1020 6 1/4	1160 7 1/4	1430 8 1/4	1660 9 1/4	1880 9 3/4	2060 10 1/4	2240 10 3/4	2400 11 1/4	2560 11 3/4	2780 12 1/4				
8-Inch	9 0 8 10	65 60	8-05	125	{ Shot } 56 { Shell } 51	5	350 1 1/2	550 2 1/2	800 3 1/2	1100 4 1/2	1300 5 1/2	1500 6 1/2	1700 7 1/4	1880 8 1/4	2060 8 3/4	2240 9 1/4	2400 9 3/4	2560 10 1/4	2680 10 3/4	2780 11 1/4					
8-Inch	8 0	54	8-05	125	{ Shot } 56 { Shell } 51	5	350 1 1/2	470 2 1/4	600 3 1/4	720 4 1/4	830 5 1/4	1030 6 1/4	1270 7 1/4	1500 8 1/4	1770 9 1/4	2030 10 1/4	2240 10 3/4	2400 11 1/4	2560 11 3/4	2700 12 1/4					

REMARKS.—The Experiments with 8-Inch Shells made on board the "Excellent" in the Autumn of 1885, and on which the tables for Shell practice were formed, were corroborated by experiments made at Woolwich on the 5th November, 1888. From which it appeared that at 1250 yards 10 lbs. of powder forced the Shell through one side, and fixed it in the other side of a section of a Line-of-Battle Ship at the lower deck, and with 8 lbs. of powder the Shell passed through the first side and rebounded from the second. At 900 yards, with charges of 8 and 10 lbs. of powder, the Shell passed through the first side and lodged in the second. At 660 yards, with a charge of 5 lbs. of powder, the Shell passed through the first side and lodged in the second. At 800 yards, with charges of 8 and 7 lbs. of powder, the Shell passed through both sides. With the 56 lbs. Hollow Shot and 10 lbs. of powder the Shot at 1250 yards passed through the first side and buried itself in the second. From that practice it was recommended that the lowest charge should be used, which would give sufficient velocity to penetrate, especially as it was observed that with 12 lbs. of powder (the then distant charge) the Shells frequently burst at the muzzle of the gun.

RANGES with SEA-SERVICE IRON ORDNANCE obtained on board Her Majesty's Ship "Excellent."

Elevation by Tangent-Sight.

The Elevation and Range in Yards, with corresponding Times of Flight.																									
Nature of Gun.	Length.	Weight.	Diameter of Bore.	Windage.	Weight of Shot or Shell.	Charge.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
82-Pr.	9	6	56	6-41	233	lbs.	440	570	700	900	1100	1280	1460	1700	1900	2100	2280	2460	2620	2780	3060	3180	3300	3420	3540
"	"	"	"	"	"	Shot 24	430	570	700	800	960	1100	1230	1350	1570	1760	1910	2100	2250	2400	2530	2660	2780	2880	2970
"	"	"	"	"	"	Shell 24	11 ³ / ₄	11 ¹ / ₂	11 ³ / ₄	12 ³ / ₄	13 ¹ / ₄	13 ³ / ₄	14 ³ / ₄	15 ³ / ₄	17 ³ / ₄	19 ³ / ₄	21 ³ / ₄	23 ¹ / ₄	24 ³ / ₄	25 ³ / ₄	26 ³ / ₄	27 ³ / ₄	28 ³ / ₄	29 ³ / ₄	
"	"	"	"	"	"	Shot 32	250	380	500	600	800	1000	1200	1380	1620	1820	2020	2200	2340	2480	2620	2760	2900		
"	"	"	"	"	"	Shell 24	350	500	620	720	880	1040	1180	1320	1520	1720	1920	2080	2230	2360	2500	2630	2740	2840	2940
"	"	"	"	"	"	Shot 32	150	280	400	500	660	820	950	1080	1240	1440	1640	1800	1960	2060	2160	2260	2360	2460	
"	"	"	"	"	"	Shell 24	200	340	460	580	740	900	1040	1180	1420	1640	1820	1980	2100	2200	2300	2380	2480	2580	

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	1	2	3	4	5	6	7	8	9	10	REMARKS.					
32-Pr(A)	8	300	440	550	700	900	1100	1350	1600	1900	2100	2280	2460	2620	2780	
"	8	380	550	640	740	910	1070	1250	1340	1550	1790	1970	2140	2310	2470	2620
		1'	1 1/2'	1 1/2'	1 1/2'	2 1/2'	3'	3 1/2'	4 1/2'	5 1/2'	6 1/2'	7 1/2'	8 1/2'	9'	10'	11 1/2'
32-Pr(B)	7	260	400	520	640	840	1020	1200	1380	1600	1820	2020	2200	2360	2520	2680
"	7	300	460	600	700	860	1030	1180	1300	1500	1700					
		2'	1 1/2'	1 1/2'	1 1/2'	2 1/2'	3 1/2'	3 1/2'	4 1/2'	5 1/2'	6 1/2'					
32-Pr(C)	6	240	360	480	600	800	960	1120	1280	1500	1700	1860	2060	2240	2420	2580
"	6	300	380	500	600	800	960	1120	1240	1460	1660					
		1'	1'	1 1/2'	1 1/2'	2 1/2'	3 1/2'	3 1/2'	4 1/2'	5 1/2'	6 1/2'					
32-Pr.	5	180	290	380	480	660	820	960	1080	1300	1500	1680	1860	2020	2180	2340
			1 1/2'	1 1/2'	1 1/2'	2 1/2'	3 1/2'	3 1/2'	4'	5'	6'					
32-Pr.	4	160	260	360	460	620	760	900	1020	1220	1420	1620	1800	1980	2140	2300
			1 1/2'	1 1/2'	1 1/2'	2'	3 1/2'	3 1/2'	3 1/2'	4 1/2'	5 1/2'					
"	2 1/2	100	200	280	360	500	620	740	820	1000	1160					
			1 1/2'	1 1/2'	2'	3 1/2'	3 1/2'	3 1/2'	3 1/2'	4 1/2'	5'					

When the Reduced charges of the heavier guns are similar to the Full charges of the lighter guns Having the same windage though of different lengths, the Ranges obtained with the lighter guns may be used as an approximation for the heavier gun.

These ranges also answer for the Reduced charge of the 32-cwt. gun and for the 32-pounder carrouse.

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Notz.—It is better, as a rule, not to fire 6-inch Shells with a higher charge than 8 lbs., as, when fired with 10 lb. charges, they sometimes burst prematurely. In firing Spherical Case from heavy guns, the Charge, Elevations, and Times of Flight may be taken as for Common Shell.

It is better, as a rule, not to fire 8-inch Shells with a higher charge than 8 lbs., as, when fired with 10 lb. charges, they sometimes burst. In firing Spherical Case from heavy guns, the Charges, Elevations, and Times of Flight may be taken as for Common Shell.

RANGES with GUNS that are nearly obsolete, single-shotted, obtained on board Her Majesty's Ship "Excellent."

Elevation by Tangent-Sight.

Nature of Gun.	Length.		Weight.	Diameter of Bore.	Windage.	Charge.	Elevation and Range in Yards, with corresponding Times of Flight.																				
	Ft. In.	In.					Cwt.	In.	In.	lbs.	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°	16°	18°	20°	24°	28°
65-Pr.	10	10	113	8.12	.108	20	500 1 ¹ / ₂	1300 33 ³ / ₄	1500 44 ¹ / ₂	1760 54 ¹ / ₂	2020 64 ¹ / ₂	2240 74 ¹ / ₂	2420 84 ¹ / ₂	2600 94 ¹ / ₂	2760 104 ¹ / ₂	2920 114 ¹ / ₂	3080 124 ¹ / ₂	3240 134 ¹ / ₂	3380 14 ¹ / ₂	3520 154 ¹ / ₂	3660 164 ¹ / ₂	3780 17 ¹ / ₂	4020 17 ¹ / ₂				
68 "	9	8	91	8.12	.108	15	820 1 ¹ / ₂	1040 3 ³ / ₄	1380 44 ¹ / ₂	1680 54 ¹ / ₂	1940 64 ¹ / ₂	2160 74 ¹ / ₂	2360 84 ¹ / ₂	2540 94 ¹ / ₂	2700 104 ¹ / ₂	2860 114 ¹ / ₂	3020 124 ¹ / ₂	3180 134 ¹ / ₂	3320 144 ¹ / ₂	3460 154 ¹ / ₂	3600 164 ¹ / ₂	3720 164 ¹ / ₂	3960 184 ¹ / ₂	4160 194 ¹ / ₂	4540 194 ¹ / ₂	4820	
68 "	9	6	87	8.12	.108	14	800 1 ¹ / ₂	1020 3 ³ / ₄	1360 44 ¹ / ₂	1660 54 ¹ / ₂	1920 64 ¹ / ₂	2140 74 ¹ / ₂	2320 84 ¹ / ₂	2480 94 ¹ / ₂	2620 104 ¹ / ₂	2760 104 ¹ / ₂	2900 114 ¹ / ₂	3040 124 ¹ / ₂	3180 134 ¹ / ₂	3320 144 ¹ / ₂	3460 154 ¹ / ₂	3580 164 ¹ / ₂	3820 174 ¹ / ₂				
56 "	11	0	97	7.65	.175	16	870 1 ¹ / ₂	1200 3 ³ / ₄	1600 44 ¹ / ₂	1900 54 ¹ / ₂	2120 64 ¹ / ₂	2320 74 ¹ / ₂	2500 84 ¹ / ₂	2660 94 ¹ / ₂	2820 104 ¹ / ₂	2980 114 ¹ / ₂	3120 124 ¹ / ₂	3260 134 ¹ / ₂	3400 14 ¹ / ₂	3520 154 ¹ / ₂	3640 164 ¹ / ₂						
56 "	10	0	87	7.65	.175	14	450 1 ¹ / ₂	1180 3 ³ / ₄	1480 44 ¹ / ₂	1740 54 ¹ / ₂	1980 64 ¹ / ₂	2200 74 ¹ / ₂	2400 84 ¹ / ₂	2580 94 ¹ / ₂	2760 104 ¹ / ₂	2920 114 ¹ / ₂	3080 124 ¹ / ₂	3220 134 ¹ / ₂	3360 144 ¹ / ₂	3500 154 ¹ / ₂	3600 164 ¹ / ₂						
42 "	10	0	84	6.97	.208	14	430 1 ¹ / ₂	1120 2 ³ / ₄	1460 44 ¹ / ₂	1740 54 ¹ / ₂	2000 64 ¹ / ₂	2220 74 ¹ / ₂	2420 84 ¹ / ₂	2600 94 ¹ / ₂	2760 104 ¹ / ₂	2900 114 ¹ / ₂	3020 124 ¹ / ₂	3140 134 ¹ / ₂	3260 144 ¹ / ₂	3360 154 ¹ / ₂	3460 164 ¹ / ₂	3560 164 ¹ / ₂	3720 184 ¹ / ₂	3880 194 ¹ / ₂	4150 194 ¹ / ₂	4360	
42 "	10	0	75	6.97	.208	12	400 1 ¹ / ₂	1100 2 ³ / ₄	1420 44 ¹ / ₂	1680 54 ¹ / ₂	1940 64 ¹ / ₂	2160 74 ¹ / ₂	2340 84 ¹ / ₂	2520 94 ¹ / ₂	2680 104 ¹ / ₂	2820 114 ¹ / ₂	2960 124 ¹ / ₂	3080 134 ¹ / ₂	3200 144 ¹ / ₂	3300 154 ¹ / ₂	3400 164 ¹ / ₂	3500 174 ¹ / ₂	3660 184 ¹ / ₂	3820 194 ¹ / ₂	4100 194 ¹ / ₂	4320	

Elevation by Spirit Level. Height above Plane 5 ft. 4 in.												
	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°		
24-Tr.	9	6	50	5-82	-211	8						
18 "	9	0	42	5-29	-193	6						
18 "	7	0	22	5-17	-071	3						
Carve- naded.												
8-inch	5	4	36	8-05	-125	5						
42-Tr.	4	6	22	6-84	-078	3½						
32 "	4	0	17	6-25	-073	2½						
24 "	3	9	13	5-68	-068	2						
18 "	3	4	10	5-16	-061	1½						
12 "	2	8	6	4-52	-056	1						

Howitzer. 12-Pr. 3 ft. 9 in. 6½ cwt.	4.58	.12	Sph. Case 10 lbs. No. of Balls 75 Burst. 1 oz. 12 drs.	1°	1½°	2°	2½°	3°	3½°	4½°	5°	6°	
				250	300	350	450	550	650	700	750	800	850	900	950	1050
				.1	.15	.2	.4	.45	.5	.6	.7	.8	
These Ranges may also be used for the Hollow Shot and Shell.													
Gun. 6-Pr. 5 ft. 6 cwt.	3.67	.12	Sph. Case 5 lbs. No. of Balls 30 Burst. 12 drs.	1°	1½°	2°	2½°	3°	3½°	4½°	5½°	6°	
				300	400	500	600	700	800	900	1000	1100	1200	1300	1400
				.1	.15	.2	.4	.5	.6	.7	.8	.9	1.0
These Ranges may also be used for the Shot.													

NOTE.—In firing Spherical Case from heavy guns, the Charges, Elevations, and Times of Flight may be taken as for Common Shell.

RANGES, by Ricochet, with SEA SERVICE IRON ORDNANCE, single-shotted, obtained on board Her Majesty's Ship "Excellent."

Elevation by Spirit Level.

Nature of Gun.	Weight.	Length.	Diameter of Bore.	Charges.	Height above the Plane.	Elevation.	First Graze.	Extreme Graze before Deflection.	No. of Grazes.	REMARKS.
10-inch	Cwt. 84	Ft. In. 9 4	Inches. 10	lbs. 12	Ft. In. 12 6	° ‡ 1 2	Yards. 280 658 770	Yards. 2850 2700 2680	16 } 14 } 18 }	The ricochet ranges were generally obtained when the water was perfectly smooth. It has been observed that a slight ripple diminishes the range considerably.
8 inch	{ 65 60 }	{ 9 0 } 8 6 }	8·05	10	12 6	‡ 1 2	340 626 970	2900 2766 2576	32 } 23 } 14 }	Ricochet ranges are not given for Shells, because the Time fuzes are always extinguished when so used.
8-inch	50	6 8	8·05	7	5 4	‡ 1 2	331 653 933	2150 2017 2333	14 } 14 } 9 }	
32-pounder....	56	9 6	6·41	10	12 6	‡ 1 2	350 800 1220	2850 2900 2650	24 15 12	

32-pounder....	50	9 0	6·375	8	5 6	.... 1 2	346 747 1173	3183 3038 2490	33 26 13
32-pounder....	45	8 6	6·35	7	5 6	.... 1 2	333 716 1040	2450 2150 2260	15 8 8
32-pounder...	42	8 0	6·35	6	5 6	.... 1 2	326 700 1026	2366 2100 2480	19 8 16
32-pounder....	39	7 6	6·35	6	12 6	.... 1 2	333 637 857	2003 1867 2007	9 8 18
32-pounder....	32	6 6	6·3	5	12 6	.... 1 2	300 580 800	1980 1800 1950	15 10 15
32-pounder....	25	5 4	6·3	4	5 4	.... 1 2	270 480 990	1980 2027 1670	21 16 6

It has been observed in ricochet firing that the nearer the gun is placed to the water (other circumstances being alike) the greater is the range of the shot. It might, therefore, in some cases, be advisable to heel the ship over, by running in the opposite guns.

RANGES with SEA-SERVICE IRON ORDNANCE, with Double Grape, obtained on board Her Majesty's Ship "Excellent."

Elevation by Tangent-Sight.

Nature of Guns.	Weight.	Length.	Charge.	Eleva- tion.	First Grape of Grape.	Extreme Range of Grape.	Spread of Grape at Yards.										Extreme Spread of Grape.
							500	450	400	350	300	250	220	200	150		
							Yards.	Yards.	Yards.	Yards.	Yards.	Yards.	Yards.	Yards.	Yards.		
32-pounder	Cwt. 56	Ft. In. 9 6	lbs. 6	° 1 2	Yards. 40 60 230	Yards. 1210 1240 1250	Yards.	Yards.	Yards. 35	Yards.	Yards.	Yards.	Yards.	Yards.	Yards.	Yards. 90 120 90	
32-pounder	50	9 0	5	1 2	130 110 130	1450 1300 1250	Yards. 35	Yards.	Yards.	Yards. ... 25 ...	Yards.	Yards.	Yards.	Yards. ... 18 ...	Yards.	Yards. 65 63 80	
32-pounder	48	8 0	5	1 2	180 170 50	1110 1320 1150	Yards.	Yards.	Yards. 35	Yards.	Yards. ... 30 ...	Yards.	Yards.	Yards.	Yards. 8	Yards. 100 120 100	
32-pounder	39	7 6	4	1 2	190 100 250	1270 1320 1320	Yards. ... 30 ...	Yards. 50	Yards.	Yards.	Yards.	Yards. 20	Yards.	Yards.	Yards.	Yards. 120 80 80	
32-pounder	25	6 0	2½	1 2	140 150 200	770 920 620	Yards.	Yards.	Yards. 60	Yards.	Yards. 15	Yards. ... 10 ...	Yards.	Yards.	Yards.	Yards. 55 65 50	

The following Remarks were made on practice obtained with Double Grape and Double Case, in December 1833 :—

The Gun (a 32-Pounder 56 cwt.) was loaded with a 6 lb. charge and Double Grape and fired with 1¼° of elevation, at the 400-yard target; they fell very close together at about 350 yards, two of the shot passing through the target, and the extreme range was about 1400 yards.

Two 32-Pounders 56 cwt. were then loaded, the one with 6 lb. charges and Double Grape, the other with 6 lb. charges and Double Case, and fired at a section of a 74-gun ship's side, distant 300 yards.

The Case Shot grazed the water at about 100 yards distance, and few of them appeared to reach the object, whereas the Grape ranged tolerably well together to 300 yards. The number of Grape fired at the ship's side was 45, out of which 18 struck, some of them passing through the side, viz., 5 inches of fir, and the rest penetrating from 2 to 3 inches in oak. The number of Case fired was 140, of which only 21 struck, 6 penetrating 1 inch in fir, 1 passed through 2¼ inches, the rest penetrated from ¼ to 1 inch in fir.

RANGES with SEA-SERVICE IRON ORDNANCE, with Single Grape, obtained on board Her Majesty's Ship "Excellent."
Elevation by Tangent Sight.

Nature of Guns.	Weight.	Length.	Charge.	Elevation.	First Grape of Grape.	Extreme Range of Grape.	Spread of Grape at Yards.						Extreme Spread of Grape.
							550	400	380	300	150	100	
32-pounder	56	9 6	6	0	Yards. 90	Yards. 950	Yards. 12	Yards.	Yards.	Yards.	Yards.	Yards.	Yards. 60
				$\frac{1}{2}$	100	1250	50	....	....	....	....	....	80
				2	100	1450	....	....	....	25	....	....	90
32-pounder	50	9 0	5	$\frac{1}{2}$	100	1350	....	....	....	....	....	18	90
				1	120	1400	....	20	....	....	....	....	35
				2	50	1500	....	....	....	60	....	....	120
32-pounder	48	8 0	5	$\frac{1}{2}$	80	1010	....	15	....	....	....	....	110
				1	250	1120	....	10	....	....	....	....	85
				2	410	1250	20	....	....	....	....	....	100
32-pounder	39	7 6	4	$\frac{1}{2}$	130	1450	....	15	....	....	....	....	100
				1	160	1400	....	8	....	....	....	....	80
				2	230	1400	10	....	....	....	....	....	70
32-pounder	25	6 0	2 $\frac{1}{2}$	$\frac{1}{2}$	290	770	....	25	....	....	....	....	70
				1	190	905	....	....	10	....	....	....	50
				2	190	906	....	40	....	....	....	....	70

June 1858.—Three rounds of Single Grape were fired from a 32-Pounder 50 cwt. with 8 lb. charges at the "Serpent," Brig, distant 750 yards; out of the 27 balls that were fired 10 struck in a space of 100 feet by 8 feet; 1 passed through the outer planking (4 in. oak); another through outer planking (4 in. fir, but rotten), and then through inner lining (3 inch oak); the remainder penetrating from 2 to 3 inches in oak.

RANGES with SEA-SERVICE IRON ORDNANCE, with Single Case-shot, obtained on board Her Majesty's Ship "Excellent."
Elevation by Tangent-Sight.

Nature of Gun.	Weight.	Length.	Charge.	Elevation.	First Graze of Case.	Extreme Range of Case.	Spread of Case at Yards.						Extreme Spread of Case.
							500	450	400	300	200	80	
32-pounder	Cwt. 56	Ft. In. 9 6	lbs. 6	° ½ 1 2	Yards. 40 30 50	Yards. 1150 1080 1090	.... .... 70	.... .... ....	.... 20 ....	.... .... ....	Yards. 15	Yards.	Yards. 140 160 130
32-pounder	50	9 0	5	½ 1 2	60 40 120	1090 1020 1200	.... .... 80	.... 80 ....	.... .... ....	.... .... ....	.... .... ....	50	120 125 175
32-pounder	48	8 0	5	½ 1 2	90 150 110	1000 1000 1000	.... .... ....	.... .... ....	60 35 30	.... .... ....	.... .... ....	.... .... ....	120 130 130
32-pounder	39	7 6	4	½ 1 2	100 110 100	1300 1150 1000	.... .... ....	.... .... ....	.... .... ....	.... .... 60	60 50 ....	.... .... ....	170 200 200
32-pounder	25	6 0	2½	½ 1 2	160 60 100	750 700 950	.... .... ....	.... .... ....	45 .... ....	.... .... 60	.... 40 ....	.... .... ....	75 120 125

PENETRATIONS OF SHOT AND SHELL WITH DIRECT FIRING.

Those at 1200 yards show the average penetrations, *in good oak*, obtained during the Experimental Firing against the "York," (old 74) in 1853.

Those at 2500 yards have been carefully calculated from the above and a few other penetrations, obtained at larger and shorter distances, and in the absence of any practice at this distance, they may be considered as a very good approximation.

Projectile.	Charge.	1200 yards.	2500 yards.
	lbs.	Inches.	Inches.
68-Pr. shot	16	45	20
32-Pr. "	10	30	12
10-inch shell	12	35	17
8-inch "	16	....	15
8-inch "	10	30	13
8-inch "	5	20	....
6-inch "	10	....	10
6-inch "	8	25	8
6-inch "	6	20	....

The following penetrations, in a *mass* of seasoned White Oak, are extracted from Capt. Dahlgren's (U.S.N.) work on Shells and Shell Guns:—

Gun.	Projectile.	Charge.	Initial Velocity.	500 yds.	1000 yds.	1500 yds.	2000 yds.
		lbs.	Feet.	Inches.	Inches.	Inches.	Inches.
64-Pr.	shot	16	1620	49·9	37·3	27·9	20·8
32-Pr. (long)	"	9	1700	38·7	26·5	18·2	12·5
" 42 cwt.	"	6	1450	32·0	22·0	15·0	10·3
" 32 "	"	4½	1250	26·4	18·5	12·7	8·8
10-inch, 86 cwt.	shell	10	1160	32·1	24·2	18·2	13·7
8-inch, 63 "	"	9	1500	33·2	23·0	15·9	11·0
8-inch, 55 "	"	7	1350	29·2	20·2	14·0	9·7

GUNNERY EXAMINATION FOR LIEUTENANT.

Mates and Midshipmen presenting themselves for examination on board H.M.S. "Excellent," are required to have a competent knowledge of the following Instructions and Exercises.

First Instruction, and Handspike drill, as in Gunnery Book, with questions on the manner of quartering men at guns, and manning both sides; on the stations and duties of powder boys; on the length and weight of the different guns in use in the navy, with the number of men allowed to each; on the weight of the different kinds of Shot and Shell; on the different parts of a gun and carriage; on filling up casualties occurring at guns; and other questions relating to the instruction.

Second Instruction.—As in Gunnery Book, including the practical working of the gun, with questions on the weight of Grape and Case, and manner of loading with Red Hot Shot, Shell, Double Shot, Shot and Shell, &c.; on unspiking guns, and other questions relating to the instruction.

Third Instruction.—As in Gunnery Book, including the practical working of the gun, with questions on the dimensions of gun gear, and other questions relating to the instruction.

Revolving Gun Exercise.—As in Gunnery Book, including the practical working of the gun, with various questions relating to the instruction.

Fourth Instruction.—As in Gunnery Book, with questions on the different charges for guns; and the distance for double-shooting; on the elevations for Single and Double Shot, Grape and Case at various distances, and with different charges.

Magazine Instruction.—As in Gunnery Book, with questions on magazines, and the manner of lighting them, and the stations for passing up powder. Every officer is also required to have a perfect knowledge of the magazines of the different ships in which he may have served, and to be able to draw a rough plan of the same.

Directions for the Use of Shells and Fitting of Fuzes.—As in Gunnery Book, with questions on the different natures of Shells, and their bursting charges.

Rocket Questions.—As in Gunnery Book, with questions on the fitting of Rockets and the use of the Scales and Augers.

Disparting Instruction.—As in Gunnery Book, with examples on each question.

Cutlass Exercise.—As in Gunnery Book, including a practical knowledge of the same, and capability of drilling men.

Rifle Exercise.—As in Gunnery Book, including a practical knowledge of the same, and capability of drilling a Company.

Fitting Gun Gear.—The Officer under examination is required to make block strops, and pass seizings; to form standing clinches for breechings; to fit breast frappings and muzzle lashings, &c.; and to form the different hitches and bends in common use.

Questions on Naval Gunnery.—As in Gunnery Book.

Drilling Quarters.—In order to prepare Officers for this part of the examination, it is recommended that Midshipmen in sea-going ships, be frequently called upon to drill their Quarters under the superintendence of the Lieutenant of the Division; the ship being occasionally supposed in different positions with respect to the enemy, as for instance, “Passing on opposite tacks,” “Coming up on the quarter,” &c., that they may know the proper orders to give under various circumstances.

N.B.—The details of the different Instructions are required to be committed to memory, except the *Notes*, which need only be read and understood.

2½ or 5 numbers are taken away for each mistake; and if 20 numbers are lost by any Officer under examination, in either of the *first three* Instructions, he is rejected at once, and also if he should be found very deficient in any other Instruction, or if he should not obtain altogether 200 Nos.

Full Nos. are 280.

First class certificates are given to those

obtaining from	..	..	..	280 to 260 inclusive.
Second Class	ditto	ditto	..	255 to 230 „
Third Class	ditto	.. ditto	..	225 to 200 „.

QUALIFICATIONS FOR SEAMEN GUNNERS.

1st. Men obtaining the certificate of "*1st Class for Gunner*," are required to be perfect in all the drills and details, as laid down in the Gunnery Books, with the exception of the Field Battery Manœuvres, Battalion Drill, and Light Infantry Exercise. They are also required to pass the Laboratory, and to go through a course of School instruction, which comprises Rule of Three, Vulgar and Decimal Fractions, Square Root, the use of Logarithms, and finding the distance of a ship at sea, or laying out a target by means of a quadrant. They are further expected to be superior Instructors.

2nd. Men obtaining the certificate of "*1st Class for Gunner's Mate*," are required to be perfect in the same drills and details as "*1st Class for Gunners*," with the exception of the Disparting Instruction, School course, and the latter part of the Laboratory course. They are also expected to be good Instructors.

3rd. Men obtaining the certificate of "*2nd Class for Captain of Gun*" are only required to know the first three Instructions, and Revolving Gun Exercise, with a few questions in the 4th Instruction, and Fitting of Fuzes, together with the practical part of the Cutlass, Rifle, Pistol, and Field-Piece Exercises. They are also expected to be able to instruct a gun's crew in their different duties.

Every seaman gunner before receiving his Certificate is required to go through a course of firing, and prove that he can lay a gun quickly, and is a good and efficient shot.

4th.—Men in Sea-going Ships are to be encouraged to qualify themselves for "*Acting Captain of Gun*" under the instruction of the Gunnery Officer, in which case they need only be required to be perfect in the *first three* Instructions, but each man before receiving his Certificate must have fired *at least* the following number of rounds, and have proved that he can *lay a gun* quickly, and is a good and efficient shot :—

120 rounds from a Rifle at objects distant from 200 to 800 yards,
a portion being fired with a rest.

20 rounds from a Revolver Pistol.

30	„	„	a 6-pounder short-practice gun.	} half being with motion.
10	„	„	a Great Gun.	

On their arrival in England to pay off, they must pass through one of the Gunnery Ships to be confirmed in their present Certificate, or to qualify for a higher grade.

N.B.—In ships carrying Pivot guns, the detail and working of a Revolving Gun may be substituted for that of a Broad-side Gun.

DIVING PRECAUTIONS AND SIGNALS.

As taught on board Her Majesty's Ship "Excellent."

Article 1. The Diving Dress and Air Pump should be carefully examined before being used, to see that all the parts are in good order; and before the Dress is put on, it is always to be screwed together, the sleeve holes tied close, and the whole pumped full of air, by which means a leak or hole would be discovered instantly by the air escaping.

As a further precaution the Diver before descending should be directed to stop on the ladder, as soon as his head is a few feet under water, to assure himself that everything is correct.

2. Great care should be taken that the Safety Valve at the back of the Helmet be examined before a man goes down, to see that it will act properly; the object of it being to allow the foul air to escape as fresh air is forced in; particular attention should also be paid to screwing on the Air pipes and seeing that proper washers are on the screws before connecting them together; and before connecting the Pipe to the Helmet, the pump should be worked, and the foul air driven out of the pipes.

This is a very necessary precaution.

3. It should be carefully ascertained that a man before going down has not been drinking spirits just previously, as though perfectly sober at the time, experience proves that the effects of it under water are so injurious as sometimes to cause men to become quickly insensible.

4. A Jacob's ladder should be fitted long enough to reach the bottom, and secured to a standing thwart in the centre of the boat; a small pig of ballast should be made fast to the bottom of the ladder to sink it, and also a Distant line about seven or eight fathoms in length, of the same size as a deep sea lead line; the use of it being to enable the Diver who holds it in his hand when on the bottom, to find his way back to the ladder.

5. When the Dress is on the Diver, and all screwed up *except* the mouth piece, the Air Pump should immediately be worked, and then the mouth piece screwed on, and the bight of the Air pipe secured by a lanyard round the body, the left arm being

through the bight. A Breast rope of three and a half inches is to be made fast in front, round the man's body, close under the arms, and secured to the Corslet by a Lanyard, to prevent it slipping down. The length of the breast rope must be equal to that of the ladder and distant line combined, and it should be secured to a thwart in the boat. The distant line is also secured to the man's wrist before going down.

6. The Breast rope and Air pipe should be carefully attended, a person being stationed to *each* to note the signals made by the man when on the bottom; the persons attending should have previously been well instructed in the manner of making the signals, and should stand up in the boat holding the breast rope and air pipe in their hands and *clear of* the gunwale. The Pump should *never* be stopped as long as the man is under water, nor afterwards, until the mouth piece is unscrewed, but the supply of air regulated by working the pump slowly or quickly as necessary.

7. Directly the Diver reaches the bottom he should give *one* pull on the breast rope, the man attending it giving *one* pull in return.

If he requires *more air* he should give *one* pull on the air pipe.

If he requires *less air* he should give *two* pulls on the air pipe.

If no signal is made by the Diver on reaching the bottom, he should be hauled up immediately by the breast rope.

8. Whilst on the bottom the Diver should be frequently signalized to, by the man attending the breast rope pulling it *once*, which should be answered by the Diver pulling in return; if the return signal at any time is not made, the man should be immediately hauled up.

9. If it is desired to direct the Diver to go to the right, *two* pulls should be given on the breast rope; if to the left, *three* pulls; and if right a-head, *four* pulls, a distinct pause being made between each pull; but it is better, as a rule, to leave the Diver to use his own judgment.

10. When the Diver wishes to come up, he should walk to the ladder and pull the breast rope quickly and *repeatedly*, whereupon he is to be hauled up immediately, the diver assisting himself by means of the ladder; and when it is considered

desirable that the Diver should ascend before he has made the signal, the same signal should be made to him by the man attending the breast rope; the Diver will then walk to the ladder, and signalize to be hauled up as before.

11. The time should be taken before the Diver descends, and if he has not been under water for some time, he should not be allowed to remain down longer than 20 minutes the first time; but after a little practice he should be allowed to judge for himself, some men being able to remain down upwards of three hours.

12 When other ships are present, application should always be made to those that have Divers on board, that they may be sent to attend upon the one going down, in preference to inexperienced persons.

13. When it is desired to examine a ship's bottom in water that is too deep to admit of the Diver reaching it when on the bottom, an Engine-room iron ladder, having a piece of plank lashed over the rounds for the man to sit upon, should be slung under the ship's bottom, with two ropes at head and foot, the ladder being suspended from two boats, one on each side. When the Diver is on the ladder, he will pull the *foremost* rope that holds either end of it if he wishes the boats to haul a-head, or the *after* rope if he wishes the boats to drop astern. If an iron ladder cannot be obtained, a grating weighted with shot should be used instead.

14. A responsible Officer should always be sent in charge of the diving boat, to see that the Diver is properly attended, and his signals carried out. No one but the Diver or other competent person should be allowed to meddle with the parts of the Air Pump, and when the diving is over for the time, it should always be locked.

N.B.—When the diving is finished, the Dress should be well cleaned with fresh water and dried, and the Air Pump should also be well cleaned and oiled before being stowed away. Care should be taken to stow the Dress in a place where it will not be likely to be injured by cockroaches, &c.

Every Diver should be allowed a copy of these Instructions.

FINIS.

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